

Music: A Mellow Out For Mechanical Ventilated Patients

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Abstract:

Music therapy holds significant promise as a complementary intervention in the ICU. Its ability to reduce anxiety, manage pain, improve physiological parameters and provide emotional support makes it a valuable addition to the care of critically ill patients with mechanical ventilation. As the body of evidence supporting its benefits continues to grow, music therapy has become an integral part of holistic ICU care, offering healing and hope beyond traditional medicine. Music can serve as a distracter by diverting attention away from an unpleasant stimulus. Musical compositions are complex blends of organized sound and is universally valued for its therapeutic properties which invokes both psychological and physiological responses within the listener. The physiological responses to music occur as music passes through the auditory cortex to the limbic system, affecting the ANS, which controls the cardiovascular, respiratory, neuroendocrine, and immune systems of the body. Music produces psychological responses by engaging the right hemisphere of the brain, which is involved in intuitive and creative methods of processing information. From the auditory cortex, music is processed in the limbic system known as the center of emotions, sensations, and feelings where by it impacts on individual's emotional state.

Conclusion: To improve the patient care and health related quality of life in mechanical ventilated patients, nurses need to use music therapy as interventions to place individuals in the best possible environment to promote health, healing, and restoration. This concept paper describes the various therapeutic mechanisms of music and discusses the physiological, psychological and hormonal effects of music on mechanical ventilated patients.

Keywords: Music therapy; Mechanical Ventilation; Physiological and Psychological effects

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I. Introduction

Mechanical ventilation is a lifesaving modality but is often associated with high anxiety and agitation. Patients undergoing mechanical ventilator support manifest discomforting symptoms such as pain, dyspnea, anxiety and agitation. The sensation of breathlessness, frequent suctioning, inability to talk, ICU alarm sounds, uncertainty regarding surroundings or condition, discomfort, frequent procedures, isolation from others, and fear contribute to high levels of anxiety. Side effects of analgesia and sedation may lead to the prolongation of mechanical ventilation and subsequently to a longer length of hospitalization and increased cost. Therefore, non-pharmacological interventions are often considered for anxiety and stress management. In this regard, music therapy emerges as a promising non-pharmacological treatment for ICU patients. Music interventions have been used to reduce anxiety, distress, improve physiological functioning of patients and promote relaxations. Music is an intriguing intervention and a simple complementary therapy with many potential benefits for mechanically ventilated patients.

II. Music – The Universal Language

Music is often considered a universal language because it can convey emotions, ideas, and cultural values without the need for words. It can influence the body, mind and spirit. Music can improve mood, decrease pain and anxiety, and facilitate opportunities for emotional expression¹. According to Cambridge dictionary “Music is a pattern of sounds made by musical instruments, voices or computers or a combination of these, intended to give pleasure to people listening to it”.

Music is a therapy and a healing medium for the mind and the body. Music is used as a therapeutic approach by health professionals to address physical, emotional, cognitive, and social needs². The world federation of music therapy defines music therapy as the “professional use of music and its elements as an intervention in medical, educational and everyday environments with individual, groups, families or

communities who seek to optimize their quality of life and improve their social, physical, communicative, emotional, intellectual and spiritual health and wellbeing”. Music therapy is a cost effective, non- invasive method; which can be simply applied by nurses, alongside nursing strategies. The ideal music for therapeutic purposes and stress relief is characterized by a steady rhythm, a low frequency, a relaxing melody and a beat pattern of 60-80 beats per minute.³

Elements Of Music Therapy

- Characteristics of music influence music perception like melody, harmony, tempo and dynamics.
- Music is influenced by how the auditory system encodes and retains acoustic information
- Physiological and psychological parameters depend on the tempo of the music.
- Regional cardiac activity is modulated by the activity of neurons within the cardiac nerve plexus³.

III. Types Of Music Based Interventions

The umbrella term ‘**music interventions**’ is used to denote all therapeutic interventions where music is the key component in effecting the desired treatment effect. Music-based interventions may include singing, performing, or creating music, moving to music, listening to music, or any combination of these. Music-based interventions can be implemented by music therapists, in the context of music therapy, but can also be self-administered or delivered by health professionals or family members (American Music Therapy Association). Studies show that music interventions are strongly associated with a wide range of positive health and well-being outcomes for a various patient population. Music therapy is proven to form healthier coping mechanism that led to the acceptance of anger as opposed to aggressive and violent behavior.^{4,5,6}

Music-based interventions for mechanically ventilated patients include:

Music medicine: Music interventions administered by medical or healthcare professionals. They offer pre-recorded music for passive listening.

Music therapy: Those implemented by trained music therapists, the presence of a therapeutic process and the use of personally tailored music experiences. These music experiences include:

- listening to live, improvised, or pre-recorded music;
- performing music on an instrument;
- improvising music spontaneously using voice or instruments, or both;
- composing music; and
- music combined with other modalities.^{7,8}

IV. Therapeutic Mechanisms Of Music

The multisensory nature of music simultaneously engages and modulate neurocognitive, perceptual, behavioral, physiological and psychosocial functions simultaneously. They activate neuro-plastic and neurochemical processes, auditory-motor coupling, neural entrainment, arousal-mood pathways, autobiographical and implicit memory, and affect attunement. Music regulates (a) cardiovascular activity, (b) limbic, paralimbic and cortical brain activity responsible for emotion (c) mesolimbic dopaminergic reward pathways, the hypothalamus-pituitary-adrenal axis stress response and (d) involuntary movement and motoric expressions. Collectively, the activation of these mechanisms results in improved memory, reduced anxiety, stress, agitation, improved attention and orientation to place, time and person, in older adults with neurological conditions.^{9,10,11} (Figure 1).

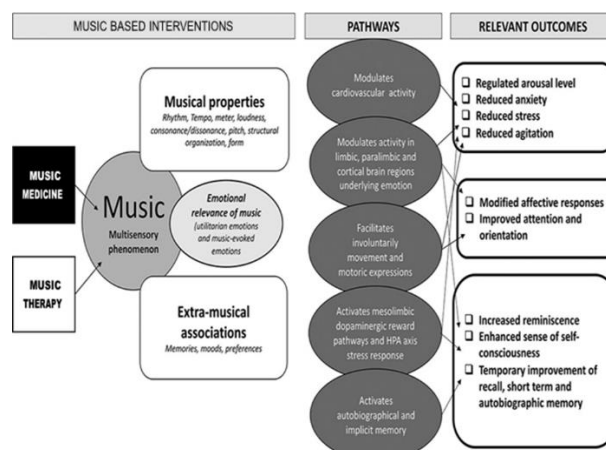


Figure 1: Therapeutic Mechanisms of Music

Perception Of Music In Brain

The way that music affects the brain is very complex. All aspects of music — including pitch, tempo, and melody — are processed by different areas of the brain. The cerebrum processes the rhythm, the frontal lobe decodes the emotional signals created by the music and a small portion of the right temporal lobe helps understand pitch. The reward center of the brain i.e nucleus accumbens, produce relaxation and strong physical signs of pleasure such as goosebumps, when it hears powerful music.

V. Effect Of Music On Physiological And Psychological Parameters

Mechanically ventilated patients commonly exhibit variations in physiological parameters and experience psychological stress.

Physiological parameters: These are measurable characteristics of the body that describe its functions and processes. It relates to the physical and chemical processes of the body. It includes Heart Rate, Respiratory Rate, Blood pressure and Oxygen Saturation

Psychological parameters: These parameters relate to the thoughts processes of the mind and abstract concepts that humans experience every day. It includes anxiety, agitation, delirium and stress.

Physiological Effects

Physiologically, music therapy contributes to reducing heart rate, respiration and blood pressure by activation of neurobiological pathways, autonomic, immune, endocrine, and neuropeptide systems associated with the regulation of music perception, emotional processing, activation of the parasympathetic nervous system and stress responses¹². (Figure:2)

Psychological Effects

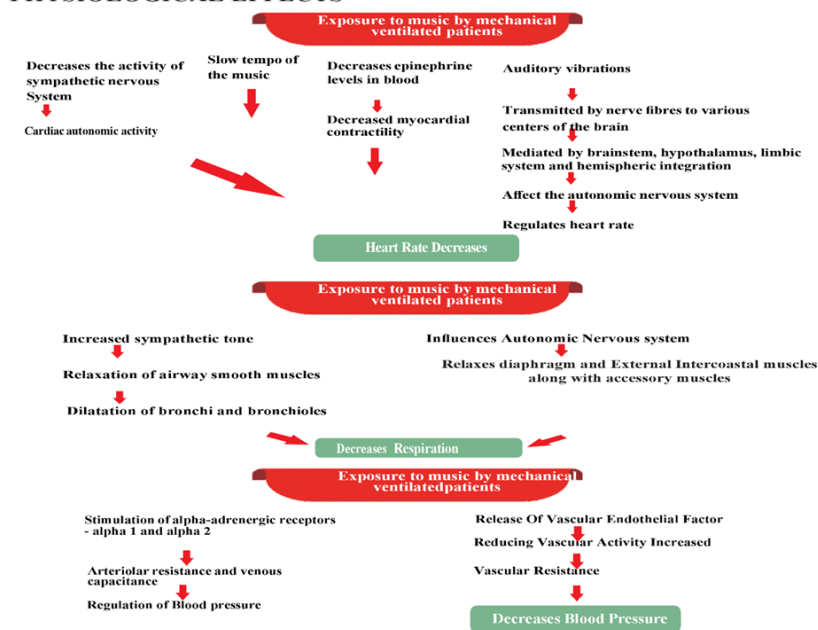
Music grabs attention of patients and acts as a distracter by diverting patient from unpleasant stimuli that lead to negative experiences. Music stimulates alpha brain waves which creates calm, immersive and functional mind state¹³. Music activates reward center of the brain also known as the mesolimbic system (Ventral Tegmental Area (VTA) and Nucleus Accumbens (NAc), which is responsible for processing rewards and motivating behavior. Music's vibrational quality influences the limbic system and evoke a psychophysiological response in the listener. Music also increases relaxation by reduction of the stress hormones due to the down-regulation of hypothalamic-pituitary-adrenal axis activity, which is elicited as reduction of serum concentrations of cortisol.¹⁴ (Figure:2)

Hormonal Effects

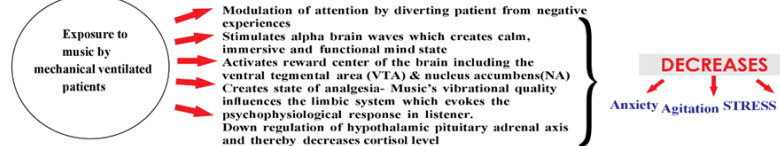
Music releases hormones like dopamine (reward chemical), oxytocin (love hormone), endorphins (pain killer), serotonin (mood stabilizers) thereby reduces anxiety, agitation and stress.

Music positively affects neurotransmitters, such as dopamine and serotonin, that influence mood. Dopamine influences focus, concentration, memory, sleep, mood and motivation. Likewise, serotonin impacts mood, sleep patterns, anxiety and pain. Music may interrupt the stress response by releasing β -endorphins, the body's natural opioid pain relievers. β -Endorphins are associated with pleasant emotions, relaxation and pain relief. Pleasing music lower the production of cortisol thereby effects psychological parameters. Listening to music can increase oxytocin levels in the brain which causes stress reduction, improves social bonding, love, increase emotional arousal and relaxation.¹⁴(Figure:2)

PHYSIOLOGICAL EFFECTS



PSYCHOLOGICAL EFFECTS



HORMONAL EFFECTS

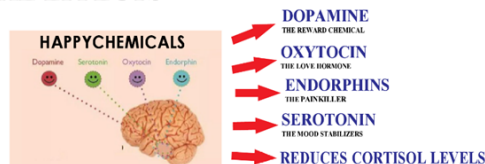


Figure 2: Effects of Music on Physiological and Psychological Parameters

VI. Clinical Evidence

Several studies have demonstrated the effectiveness of music therapy in the ICU setting. A study by Amanda J Golino et.al. (2023) found that mechanical ventilated patients who received music therapy had significantly lower levels of agitation, pain and reduced heart rate compared to those who did not receive music therapy¹⁵. Similarly, a systematic review by Rebecca Menza et al (2024) concluded that use of MBIs improved symptom experience for critically ill adults during MV¹⁶. In another study, Caliskan et al. (2024) reported that music therapy and sound isolation interventions affected the hemodynamic parameters of the patients and reduced the severity of pain perceived by the patients and the need for sedation¹⁷.

Han et al. (2010) reported that music therapy reduced the need for sedatives in ICU patients, suggesting that it could be an effective adjunct to pharmacological interventions. Moreover, a meta-analysis by Trappe (2012) highlighted that music therapy could improve heart rate and respiratory rate, contributing to better overall physiological stability.

In a broader clinical context, a randomized controlled trial by Golino AJ et al. (2019) found that ICU patients who received active music therapy experienced reduced stress levels and improved sleep quality compared to those who did not receive music therapy¹⁸. Additionally, a study by Lee et al. (2012) demonstrated that music therapy could enhance the overall patient experience in the ICU, contributing to higher satisfaction rates among patients and their families¹⁹.

While the benefits of music therapy in the ICU are well-documented, there are challenges to its widespread implementation. Implementing music therapy requires resources, including trained therapists and appropriate equipment. In resource-limited settings, these may not be readily available. There may be a lack of awareness or acceptance of music therapy among healthcare professionals and patients. Educating stakeholders about the benefits and evidence supporting music therapy is crucial.

VII. Conclusion

Music therapy is a non-invasive, non-pharmaceutical and an efficient practice to abate the ICU induced anxiety, agitation and stress among intensive care unit patients. It also possesses the ability to stabilize the main physiological parameters of intensive care unit patients. Study recommends the use of music therapy for ICU patients to stabilize their psychological and physiological parameters. Overall, nurses need to use music therapy as interventions to place individuals in the best possible environment to promote health, healing, and restoration.

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