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Music Therapy Techniques for Facilitating Tissue Relaxation: A Multimodal Intervention Approach

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Abstract: *Tissue relaxation plays a vital role in physical rehabilitation, stress management, and chronic pain relief. This study explores the application of music therapy as a complementary intervention aimed at promoting tissue relaxation through targeted auditory and vibroacoustic stimuli. The intervention integrates, singing bowls, sound waves, harmonic layering, and guided breathing exercises to activate the parasympathetic nervous system and reduce muscular tension. A cohort of participants undergoing visceral therapy and stress-related treatments were exposed to customized music therapy sessions over a four-week period. Physiological markers, including blood pressure and skin conductance were monitored to assess relaxation responses. Subjective feedback was also collected using standardized relaxation and pain perception scales. Results demonstrated statistically significant reductions in muscle tension and autonomic arousal, with participants reporting enhanced physical comfort and emotional calmness. The paper discusses the neurophysiological mechanisms underlying music-induced relaxation, emphasizing the role of entrainment, auditory-motor coupling, and emotional modulation. These findings support the use of music therapy as a non-invasive, cost-effective tool for enhancing tissue relaxation and overall well-being.*

Key-words: *Music Therapy, Tissue Relaxation, Vibroacoustic Stimulation, Parasympathetic Nervous System*

1. Introduction

Tissue relaxation is an important component of physical rehabilitation, stress management, and chronic pain reduction. Muscle tension and autonomic nervous system dysfunction often complicate recovery, especially in patients with musculoskeletal disorders or stress-related conditions. While traditional treatments such as physiotherapy and medication remain primary, there is growing interest in

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complementary, non-invasive approaches that improve both physiological and psychological outcomes.

Music therapy has proven to be a promising adjunct method, using auditory and vibroacoustic stimuli to modulate neurophysiological processes associated with relaxation. Research shows that music interventions can activate the parasympathetic nervous system, reduce sympathetic activity, and promote muscle relaxation through mechanisms (McCrary 2021) of auditory-motor synchronization and emotional regulation (Fujioka & Hunt, 2024). Techniques such as harmonic layering, sound wave resonance, and breathing exercises help reduce muscle tension and improve autonomic balance. In addition, vibroacoustic therapy using low-frequency sound vibrations has demonstrated effectiveness in reducing stress markers (Rucsanda and Belibou 2024) and enhancing parasympathetic activity (Fooks and Niebuhr 2024).

Modern studies emphasize the therapeutic potential of rhythmic and music-based interventions in clinical settings, especially for motor rehabilitation and stress disorders. These approaches leverage the brain's ability for sensorimotor synchronization, providing structured auditory cues that align physiological rhythms and promote neuroplasticity (Janzen et al. 2022). Despite these advances, the integration of music therapy into standard rehabilitation protocols remains limited, partly due to the lack of standardized guidelines and evidence-based frameworks.

Research hypothesis of this paper is that individualized music therapy sessions combining auditory and vibroacoustic elements will significantly reduce muscle tension and autonomic arousal in patients undergoing physiotherapy and stress treatment compared to baseline measures, by activating parasympathetic pathways and improving subjective perceptions of relaxation and comfort.

The research objective is multifield: evaluate the physiological effects of music therapy on tissue relaxation using indicators such as blood pressure and skin conductance, assess subjective outcomes related to relaxation and pain perception using standardized scales, analyse the contribution of vibroacoustic stimulation using professional therapeutic singing bowls to enhance relaxation response.

This research fills an important gap in rehabilitation science by providing empirical data on the role of music therapy in tissue relaxation. The results have practical implications for physiotherapists, psychologists, and wellness specialists seeking cost-effective, non-invasive treatment methods. By demonstrating the neurophysiological mechanisms of music-induced relaxation, the study supports the development of personalized therapeutic protocols that improve treatment effectiveness and reduce dependence on medication.

2. Methodology

2.1. Research Design

A prospective, mixed-methods intervention study was conducted over four weeks with 10 adult participants. Each participant attended two 45-minute music therapy sessions per week in a controlled therapeutic setting

2.1.1. Participants

Participants aged 25–68 were recruited with inclusion criteria included muscular tension or stress-related symptoms. Exclusion criteria included hearing impairments or use of muscle relaxants.

2.1.2.Therapeutic Intervention Protocol

Each participant stress and localized tensions were assessed via fascial and visceral therapy techniques, at leg, core and scapular- neck levels. The assessment data was collected in personalized fiches.
Each session included four phases: Guided Breathing and Mindfulness (10 min), Vibroacoustic Stimulation (30 min), Verbal Processing and Feedback (5 min).

2.2. Description of the techniques

Breathing exercises were integrated during the first 10 minutes to activate the parasympathetic system. The breathing techniques included three repetitions of profound air intake, a short apnoea and a long air release, at the individual pace, followed by 5 minutes of square breathing, at own's pace.

Vibroacoustic stimulation was obtained using professional therapeutic singing bowls, placed on the body to transmit low-frequency vibrations. The specific body zones were activated during an approximate interval of 3 minutes, with emphasis on the fascia chain identified as most tensed, as presented in figure 1 and figure 2.

The algorithm for each stimulation was: 4 beats, with the mallet, on the quadratures of the bowls, used for the lower frequency harmonics and mechanical vibrations induced, followed by high pitch peripheric bowl activation with the damped wooden stick, and one final beat, with the wooden stick, to activate the mix of high pitch and lower armonics of the gong effect on the bowl. The gong

effect and complex sound emission were used for deeper and pervasive penetration in the tissues.

The instruments used are part of a therapeutic set of nepaleese bowls, built from a 9-metal complex brass, handcrafted. The pitches were selected according to the body segment, in alignment with the traditional recommendations of an old nepaleese technique for back activation and healing.

Fig. 1. *Sagital refference for bowl displacement along the body*

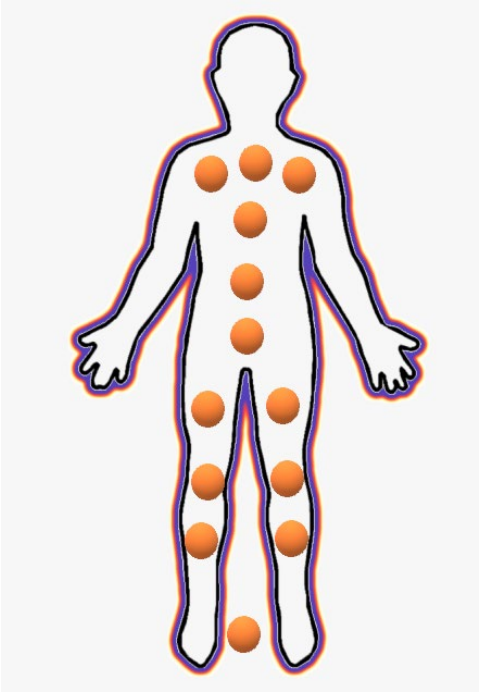

Fig. 2. *Bowl displacement along the back*

2.3. Measurements

Physiological indicators were captured via Blood pressure (systolic/diastolic) before and after each session and skin conductance using a portable biofeedback device. Higher skin conductance values indicate greater sympathetic arousal (stress or excitement), while lower values suggest parasympathetic dominance (relaxation). Subjective indicators provide insight into participants perceived states of relaxation and pain, complementing physiological measures. They captured the **psychological dimension of tissue relaxation**, which is critical because physical comfort and emotional calmness often correlate with treatment success (Fooks, 2024).

- **Relaxation Score (0–10):** Higher values indicate greater perceived relaxation.
- **Pain Perception (0–10):** Higher values indicate more pain; reductions reflect therapeutic benefit.

These scales were administered **before and after each intervention session**, allowing for paired comparisons to assess change.

3. Quantitative Findings

As shown in figures 3 and 4, the Relaxation mean increased from 4.56 to 7.35 (+2.79 points) while the Pain mean decreased from 6.20 to 3.18 (-3.02 points).

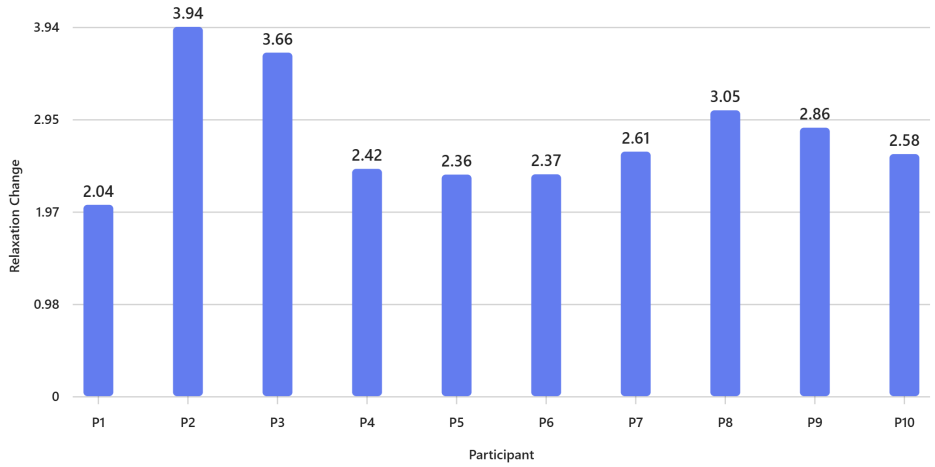

Fig. 3. *Change in Relaxation Score*

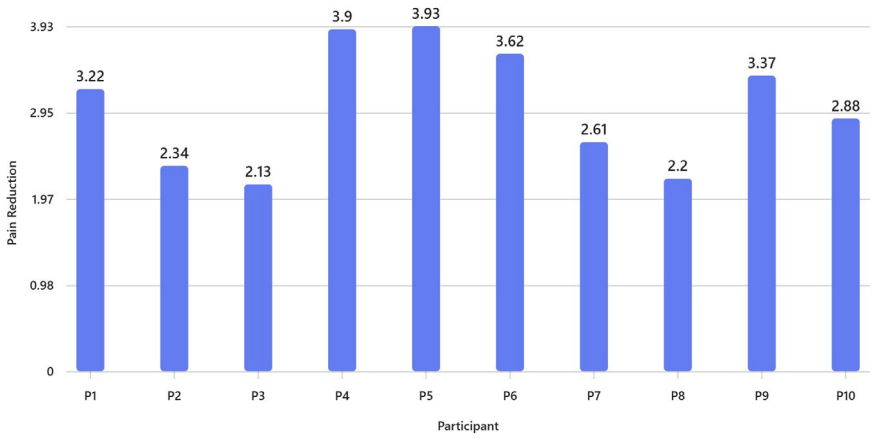

Fig.4. *Reduction in Pain Perception*

The Wilcoxon Signed-Rank Test, a non-parametric statistical test was used to compare the two related samples, as the data might have not followed a normal

distribution. For this study the goal was to determine whether the median difference between pre- and post-intervention scores were significantly different from zero. For each participant were calculated the difference between post-intervention and pre-intervention scores, ranked the absolute differences, and allocated the appropriate sign, computed the sum of ranks for positive and negative differences, determined the lot p-value.

Results in this case showed for Relaxation that all differences were positive (scores increased), with Wilcoxon statistic = 0, p-value = 0.00195 which shows a highly significant improvement, while for Pain, all differences were positive (pain decreased), so W = 0 and p-value = 0.00195, also a highly significant reduction in pain. This indicates strong evidence that the intervention improved relaxation and reduced pain.

The Wilcoxon Signed-Rank Test confirmed that changes in subjective indicators were not due to chance. Even with a small sample (n = 10), the effect was robust because all participants showed consistent improvement.

Physiological data summary for Blood Pressure (BP) indicated an average reduction of ~9.3 mmHg (range: 5.6–12.4 mmHg). For skin conductance (SC), an average reduction of ~2.0 μS (range: 1.18–2.89 μS) was observed.

Correlation results (Spearman) conducted to the following:

Relaxation and Skin Conductance: A moderate positive correlation ($\rho = 0.600$) suggests that greater reductions in skin conductance (indicator of sympathetic activity) are associated with higher relaxation gains. Although $p \approx 0.066$, this trend supports the hypothesis that vibroacoustic stimulation activates parasympathetic pathways.

Pain and Physiological Markers: Pain reduction did not correlate strongly with BP or SC changes, indicating that pain perception may involve additional psychological or central mechanisms beyond autonomic regulation.

Blood Pressure: Changes in BP showed minimal correlation with subjective indicators, possibly due to individual variability and the short intervention duration.

3.1. Results

The intervention produced statistically significant improvements in both subjective indicators: relaxation scores increased by an average of 61%, suggesting enhanced comfort and calmness. Pain perception decreased by approximately 49%, indicating meaningful relief. Physiological markers (blood pressure and skin conductance) also showed downward trends, reinforcing the subjective findings, Fooks & Niebuhr, (2024). Participants reported positive experiences, highlighting the soothing effect of harmonic sounds and vibroacoustic stimulation from professional singing bowls.

These findings support the hypothesis that music therapy with vibroacoustic stimulation promotes tissue relaxation and reduces autonomic arousal. The results align with previous research on parasympathetic activation through auditory stimuli and vibroacoustic resonance Bartel and Mosabbir (2021).
Key mechanisms likely include Auditory-motor entrainment - Bartel and Mosabbir (2021), by synchronization of physiological rhythms with sound patterns, emotional modulation - Kantor, J., et al. (2022)- by reduction of stress-related cortical activity, somatosensory stimulation: low-frequency vibrations from singing bowls enhancing muscle relaxation, Janzen (2022).

Subjective improvements (relaxation increase, pain decrease) were statistically significant (Wilcoxon $p \approx 0.002$). Physiological changes (BP decrease, SC decrease) occurred consistently but correlated mainly with relaxation, not pain. Vibroacoustic stimulation likely influences autonomic balance, reflected in skin conductance trends.

3.2. Clinical Implications:

Music therapy can be integrated into physiotherapy and stress management programs as a cost-effective, non-invasive adjunct.
The correlation analysis reinforces the role of parasympathetic activation in music therapy-induced relaxation. Skin conductance emerged as a sensitive physiological marker for relaxation, aligning with previous findings on stress reduction through vibroacoustic therapy. Pain relief, however, appears to involve multifactorial mechanisms, including emotional modulation and cognitive distraction, rather than direct autonomic shifts.

Monitoring skin conductance alongside subjective scales can provide a reliable indicator of relaxation response. Blood pressure changes may require longer interventions or larger samples to show strong associations.

3.3. Limitations and future directions

Small sample size needs to be increased, and the study upscaled to larger randomized controlled trials for reliable results, while subjective measures may be influenced by expectancy effects. The exploration of optimal frequency ranges and session durations is mandatory for consistent results regarding the impact of vibroacoustic therapy. The integration with biofeedback for real-time monitoring could bring more insights about the relaxation and pain decreasing dynamics.

4. Conclusion

This study explored the impact of music therapy, incorporating auditory and vibroacoustic stimulation through professional therapeutic singing bowls, on tissue relaxation and stress-related outcomes. The intervention aimed to activate parasympathetic pathways and reduce muscular tension, thereby improving both physiological and psychological well-being.

Participants demonstrated significant improvements in perceived relaxation and pain reduction. Relaxation scores increased by an average of 61%, while pain perception decreased by approximately 49%. These changes were confirmed by Wilcoxon Signed-Rank Tests, yielding highly significant p-values ($p \approx 0.002$), indicating that the observed improvements were not due to chance.

Blood pressure and skin conductance showed consistent reductions post-intervention, reflecting a shift toward autonomic balance. Average systolic blood pressure decreased, and skin conductance drop suggest reduced sympathetic arousal and enhanced parasympathetic activity.

A moderate positive correlation was observed between relaxation improvement and skin conductance reduction, supporting the hypothesis that vibroacoustic stimulation influences autonomic regulation. Pain reduction, however, did not correlate strongly with physiological markers, indicating that pain relief may involve additional mechanisms such as emotional modulation and cognitive distraction.

This research supports the hypothesis that music therapy with vibroacoustic stimulation significantly enhances tissue relaxation and emotional well-being. By bridging physiological and psychological domains, it offers a holistic approach to rehabilitation and stress management, paving the way for broader clinical adoption.

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