Music Therapy Increases Comfort and Reduces Pain in Patients Recovering From Spine Surgery

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Abstract

The treatment of pain continues to gain in saliency as a component of defining best practice in medical care. Music therapy is an integrative treatment modality that impacts patient outcomes in the treatment of spinal pain.

At Mount Sinai Beth Israel, we conducted a mixed-methods study addressing the effects of music therapy interventions on the recovery of patients after spine surgery. The study combined standard medical approaches and integrative music therapy. Sixty patients (35 female, 25 male) ranging in age from 40 to 55 years underwent anterior, posterior, or anterior-posterior spinal fusion and were randomly assigned to either music therapy plus standard care (medical and nursing care with scheduled pharmacologic pain intervention) or standard care only. Measurements for both groups were completed before and after the intervention. Music therapy involved the use of patient-preferred live music that supported tension release/relaxation through incentive-based clinical improvisation, singing, and/or rhythmic drumming or through active visualization supported by live music that encompasses tension resolution.

The control and music groups showed significant differences in degree and direction of change in the visual analog scale (VAS) pain ratings from before to after intervention ($P = .01$). VAS pain levels increased slightly in the control group (to 5.87 from 5.20) but decreased by more than 1 point in the music group (to 5.09 from 6.20). The control and music therapy groups did not differ in the rate of change in scores on Hospital Anxiety and Depression Scale (HADS) Anxiety ($P = .62$), HADS Depression ($P = .85$), or Tampa Scale for Kinesiophobia ($P = .93$). Both groups had slight increases in HADS Anxiety, comparable decreases in HADS Depression, and minimal changes in fear-related movement (Tampa scale).

About 70% of people in the United States experience at least 1 episode of back pain in their lifetime,[1] and more than 5 million are temporarily or permanently disabled by spinal disorders.[2-4] Some require surgery, which may rectify injury, but pain during recovery is often inevitable, and the road to recovery is not guaranteed to be smooth.[5-20]

Postoperative spine patients are at major risk for pain management challenges.[14,15,18,20] Treatment is primarily pharmacologic and based on the surgical team's pain management orders. Nursing care consists of monitoring the airway, vital signs, and neurovascular status and having patients rate their pain on a visual analog scale (VAS; 0 = no pain, 10 = worst pain imaginable). Nurses have the challenge of monitoring and continually assessing to make sure patients are achieving the optimal outcomes, particularly during the immediate postoperative period, when pain and anxiety are

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Take-Home Points

- Music therapists use patient-preferred live music, increasing neurologic cues that enhance movement—a seminal recovery function in postoperative spine patients.
- Music therapy is an evidence-based, integrative treatment addressing body, mind, and spirit.
- Tension release through music therapy can serve as a critical mechanism for building resilience related to pain management.
- Music therapy and music medicine are distinct forms of clinical practice that focus on mind-body integration in the healing process.
- Music therapists, board-certified and licensed by the state as recognized healthcare professionals, address pain management, which is an increasing subspecialty in postoperative care.

prominently increased.

Variability in spine surgery outcomes can be explained at least partly on the basis of prognostic psychological factors, including hypochondriasis, hysteria, depression, and poor pain coping strategies (eg, catastrophizing).[21] In spine surgery patients, kinesiophobia (fear of moving) is a common component of distress that can impede recuperation.[21-23] Psychological interventions that assist with the secondary stressors associated with pain and loss during physical recuperation are recommended, with increased attention given to the importance of treating the whole person: body, mind, and spirit.[24-29] Conventional pain-alleviating medical interventions can be enhanced with integrative therapies that empower patients to marshal their inner resources during recovery.[25-28] Music therapy may be particularly suited to this effort, as it is adaptable to the patient's individual and culturally specific needs.[29-33]

Rationale for Live Music

Pain is subjective and personal, and warrants an individualized approach to care. There is a body of music medicine research on the use of recorded music in modulating psychological and physiological factors in pain perception.[30,32,34-54] This research supports the unique relationship of music to well-being, and the understanding that controlling any of these factors affects the duration, intensity, and quality of that experience.[41,43,52]

These findings provide incentive for breathing-entrained music therapy interventions, which enhance the relaxation response and release of pain-related tension;[32,55-58] empower patients to unlock physical and emotional tension;[32,57,58] provide a channel for expression and body movement; and enhance blood flow and/or alleviate pain by activating neurologic areas involved in the experience of pain.[59-62]

Studies have found that physical endurance may be enhanced when movement is rhythmically coordinated with a musical stimulus.[63-66] Music may prolong physical endurance by inhibiting psychological feedback associated with physical exertion related to fatigue, which may translate into accelerated recovery periods. When we listen to a rhythmic sound, our brains tend to automatically synchronize, or entrain, to external rhythmic cues that can stimulate increased motor control and coordination.[63] Sound can arouse and raise the excitability of spinal motor neurons mediated by auditory-motor neuronal connections on the brain stem and spinal cord level.[64-66] Rhythmically organized sounds serve as a neurological function in our capacity to organize predictable timing cues that are apparent in music, and may result in an effective treatment intervention in recovery.[63,64]

Music Therapy in Recovery From Spine Surgery

In music therapy, music is used within a therapeutic relationship to support or affect change in the patient and the treatment regimen.[32,33,56-58] Research on music therapy with patients who are recovering from spine surgery is scant.[67-69] Kleiber and Adamek[67] studied perceptions of music therapy in 8 adolescents after spinal fusion surgery. In their study, a music therapist provided patients with a postoperative music therapy session focusing on the use of patient-preferred live music for relaxation and expression. Although their qualitative query was based on a therapeutic approach similar to that used in the present study, only 1 session was offered during the recovery period, and follow-up was conducted by survey invitation and telephone. In addition, the number of participants was small, and there was no quantitative measure of pain or other symptoms.

Another study focused on the effects of listening to music on pain intensity and distress after spine surgery.[68] Patients in the study's music group made their selections from prerecorded classical music and domestic and international popular songs from various genres and listened to their chosen recordings 30 minutes a day. Although the study was not a music therapy study per se, it showed a positive impact of listening to music on anxiety and pain perception in 60 adults who were randomly assigned to the music group or to a non-music control group (n = 30 in each). Differences between the music and control groups' VAS ratings of anxiety (*P*s = .018-.001) and pain (*P* = .001) were statistically significant.

Different from our study, the aforementioned studies did not include tension release–focused live music offered within a therapeutic relationship. Our 1.5-year pilot study, conducted prior to the present

study indicated that music therapy led to increased resilience and recovery mechanisms.[58]

Methods

Our mixed-methods study design combined standard medical treatment with integrative music therapy interventions based on pain assessments to better understand the effects of music therapy on the recovery of patients after spine surgery.

The Spine Institute of New York within the Department of Orthopedic Surgery at Mount Sinai Beth Israel provides surgical treatment of common spinal cord conditions. Prioritizing patient satisfaction and positive outcomes,[27,28] the institute integrates music therapy through the Louis Armstrong Center for Music and Medicine to enhance treatment of pain symptoms.

Patients were recruited by the research team as per the daily surgical schedule, or through referral by the medical team or patient care navigator. Sixty patients (35 female, 25 male) ranging in age from 40 to 55 years underwent anterior, posterior, or anterior-posterior spinal fusion and were enrolled in the study after signing a participation consent form. Minorities, women, and patients with Medicaid and Medicare were included. Patients who received a diagnosis of clinical psychosis or depression prior to spine injury were excluded.

The experimental group received music therapy plus standard care (medical and nursing care with scheduled pharmacologic pain intervention), and a wait-listed control group received standard care only. A randomization chart created by a blinded statistician who did not have access to the patient census determined the intervention–nonintervention schedule. Patients in the music therapy group received one 30-minute music therapy session during an 8-hour period within 72 hours after surgery.

For both groups, measurements were completed before and after the study window. Control patients were offered music therapy after completion of the post-intervention surveys in order to minimize the ethical dilemma of denying potentially helpful pain intervention. For this same reason, both groups were given the option of receiving follow-up music therapy sessions for the duration of their hospitalization.

The research team consisted of 2 licensed, board-certified music therapists. In addition, Master's-level music therapy interns completing clinical hours as part of the trajectory for board certification served on the research team over the 5-year period 2009 to 2014, and 13 blinded research assistants helped with enrolling and collecting data on patients.

Intervention

Each music therapy session included a warm-up phase of verbal or musical discourse. Next was the treatment phase, which was based on patient need as assessed during warm-up. Treatment options included use of patient-preferred live music that supported tension release/relaxation through incentive-based clinical improvisation, singing, and/or rhythmic drumming or through breathwork and visualization. Psychoeducation about mind–body awareness through the use of breath and imagery was introduced and explained by the therapist at this time.

The improvised music intervention was focused on making salient the natural harmonic tension-resolution cycles that occur in music and that were entrained to the patient's presentation (respiratory rate, verbal report, clinical presentation). When patient-preferred precomposed songs were used, tension resolution was achieved by sustaining cadence and resolution, also entrained to the patient's respiratory cycles.[32,57,58]

After the music therapy intervention, a period of closure or integration was facilitated by the therapist contingent on the patient's degree of alertness. If awake, the patient was supported in a reflexive process of thoughts, impressions, or issues that may have contributed to the overall experience. If the patient was asleep, the researcher returned within 30 minutes for post-intervention interviewing. Interview information was recorded in a qualitative post-participation survey. To prevent bias, researchers who were not the treating clinicians conducted the surveys.

Outcome Measures

Both primary and secondary outcome measures were collected before and after the intervention. The primary outcome measure was VAS pain ratings, and the secondary outcome measures were scores on the Hospital Anxiety and Depression Scale (HADS), the Tampa Scale for Kinesiophobia (TSK), and the Color Analysis Scale (CAS).

VAS. With the VAS, images are used to rate pain. The scale has points labeled 0 to 10 and corresponding faces representing progression in pain intensity. The scale is quickly rendered and can be interpreted according to the patient's recovery phase at time of rendering.

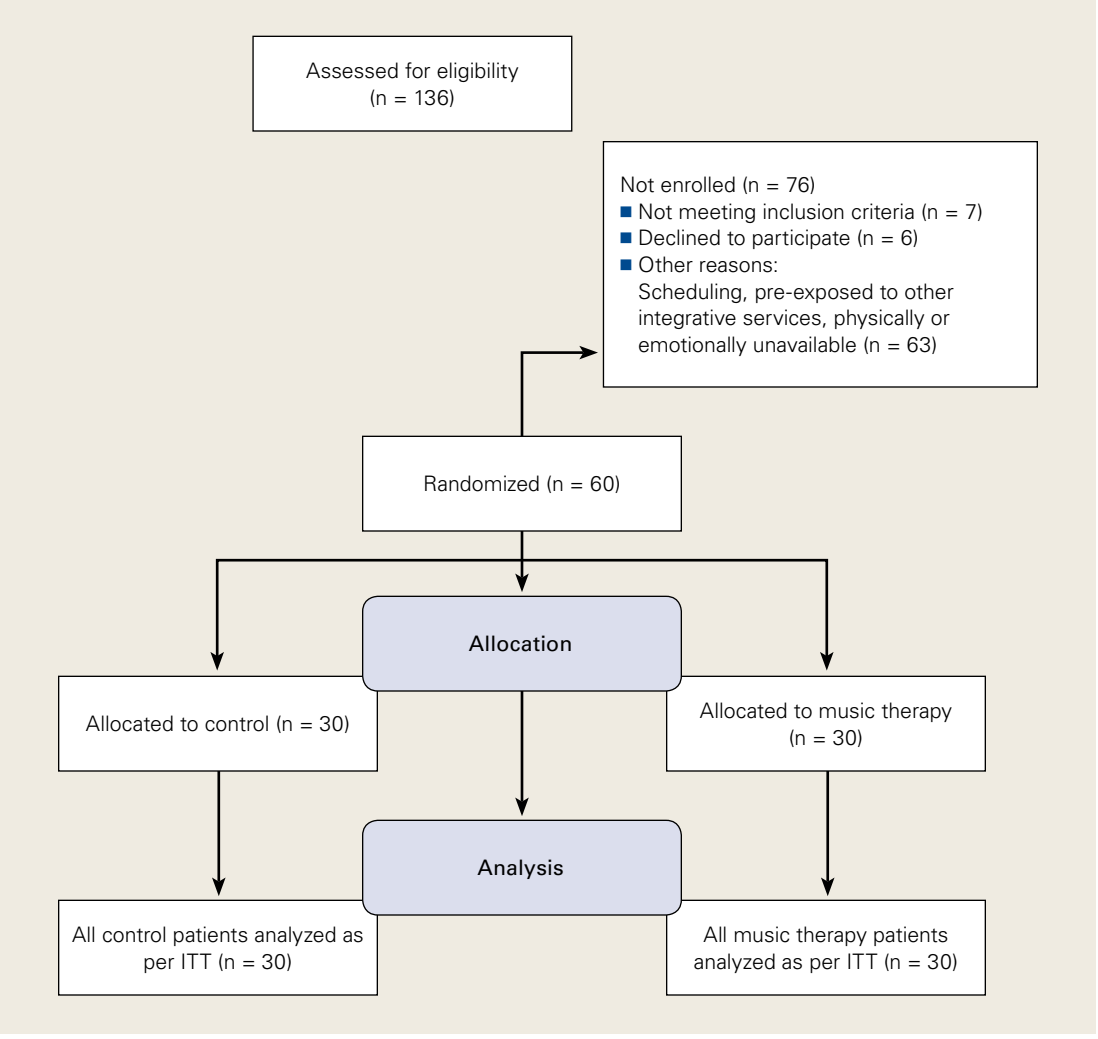

Figure 1. Flow of participant enrollment.
Abbreviation: ITT, intent-to-treat.

HADS. The HADS[70] provides a specific baseline for anxiety and depression as an indicator of how the patient might fare during hospitalization (admission through recovery and discharge).

TSK. The TSK[71] provides insight into the patient's perception of fear-related movement, which is an important factor in this study because of the movement required for rehabilitation. We used a shortened version of the TSK to accommodate the sensitive threshold for pain tolerance and pharmacologic side effects commonly experienced by spine patients.

CAS. The CAS was developed at the Louis Armstrong Center for Music and Medicine to assess comorbidities and dynamic aspects of pain. Through a coloring exercise, patients illustrate their pain experience, which gives tangible form to the abstract experience of pain.

Coding

We collected patients' demographic data, including age, sex, and diagnoses. Clinical indicators of the preoperative baseline included lifestyle, surgical history, and prior experience with music or other mind–body strategies for self-regulation.

As fundamental to qualitative methodology,[72,73] the reported responses to questions were grouped into themes that were peer-tested with members of the research team before and during the coding process. The **Appendix** shows the *Spine Study: Data Collection Form* that was used.

VAS, HADS, and TSK data were tabulated by blinded research assistants and analyzed by a statistician. Patients were identified by number assignment, and their data and personal information were kept confidentially stored.

Table 1. **Demographic and Clinical Characteristics of Control and Music Groups**

Characteristic	Group (n = 30 in each)		*P*
	Control	Music	
Mean (SD) age, y	47.83 (4.93)	48.56 (4.05)	.58
Female sex, n (%)	20 (67%)	15 (50%)	.24
Prior surgery, n (%)			.84
Spine	14 (47%)	16 (53%)	
Other	10 (33%)	8 (27%)	
None	6 (20%)	6 (20%)	
Type of fusion surgery, n (%)			.77
Anterior	7 (23%)	5 (17%)	
Posterior	13 (43%)	13 (43%)	
Both	10 (33%)	12 (40%)	
Prior trauma, n (%)	14 (47%)	16 (50%)	1.00
Prior music experience,[a] n (%)	19 (63%)	24 (80%)	.25
Perspective on surgery, n (%)			.13
Optimistic	19 (63%)	20 (67%)	
Indifferent	4 (13%)	8 (27%)	
Pessimistic	7 (23%)	2 (7%)	
Median (minimum, maximum) length of stay, d	6 (2, 16)	5 (3, 31)	.16

[a]Experience as performer, student, or concertgoer.

Statistical Methods

Means and standard deviations were used for continuous variables, and frequencies (percentages) for categorical variables. All outcomes were analyzed on an intent-to-treat basis. Repeated-measures analysis of variance was used to compare changes in outcomes from before to after intervention for the music and control groups. In particular, a statistically significant Group (music vs control) × Time (before vs after intervention) interaction would support the hypothesis that there would be more benefit (less pain) in the music group as a result of the music therapy. For all tests, significance was set at $P < .05$. SPSS Version 20 (IBM) was used for all statistical analyses. Based on previously found differences in heart rate and mobility,[31] we assumed an effect size of 0.71 for the difference between music and control (no music), which would require 32 patients per group to achieve a power of 0.8 with an α of 0.05.

Results

Of the 136 patients who were asked to participate in the study, 76 were not enrolled; the other 60 were equally assigned to either the control group or the music therapy group (n = 30 in each) according to randomization indicated by a blinded statistician (**Figure 1**). All outcomes were measured before and after intervention. **Table 1** summarizes the demographic and clinical characteristics of the control and music therapy patients. There were no statistically significant clinical differences between the groups in terms of any demographic or clinical characteristic. Mean age was 48 years for the control group and 49 years for the music group ($P = .58$). Sixty-seven percent of control patients and 50% of music patients were female ($P = .24$). Baseline perspectives with regard to the outcome of their surgery are also included (Ps > .05).

Table 2 lists the pre-intervention and post-intervention comparisons of the main outcomes between groups. The groups showed significant differences in degree and direction of change in VAS pain ratings ($P = .01$). VAS pain levels increased slightly in the control group (to 5.87 from 5.20) but decreased by more than 1 point in the music group (to 5.09 from 6.20) (**Figure 2**). The control and music groups did not differ in the rate of change in scores on HADS Anxiety ($P = .62$), HADS Depression ($P = .85$), or TSK ($P = .93$). Both groups had slight increases in HADS Anxiety,

Table 2. **Outcome Variables of Control and Music Groups Before and After Intervention**

	Group				
	Control		Music		
Outcome Variable, mean (SD)	Before	After	Before	After	*P*[a]
VAS pain	5.20 (2.82)	5.87 (2.58)	6.20 (2.48)	5.09 (2.49)	.01
HADS Anxiety	9.50 (3.64)	10.90 (3.14)	8.53 (3.78)	9.57 (4.30)	.62
HADS Depression	7.83 (3.92)	7.27 (3.53)	7.87 (4.26)	7.47 (4.95)	.85
TSK	31.57 (5.49)	30.53 (5.95)	30.70 (7.34)	31.10 (7.68)	.93

Abbreviations: HADS, Hospital Anxiety and Depression Scale; TSK, Tampa Scale for Kinesiophobia; VAS, visual analog scale.
[a]*P* for Group (music vs control) × Time (before vs after intervention) interaction.

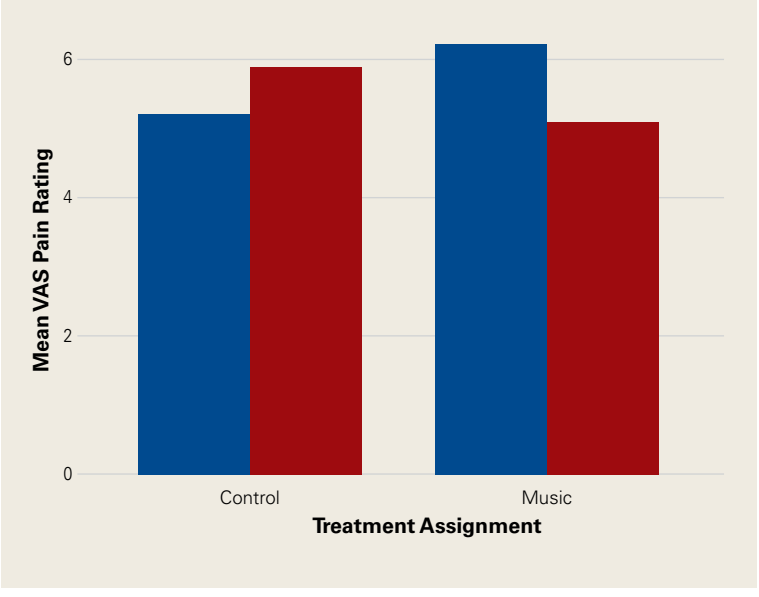

Figure 2. Visual analog scale (VAS) pain ratings of control and music groups before and after intervention.

comparable decreases in HADS Depression, and minimal changes in TSK.

The emerging themes of the responses are listed in **Tables 3 and 4** and are explained here: Relationship with music was coded for significance and included reports of music as a resource accessed for stimulation and/or relaxation through listening; direct involvement with instrument playing; and history of music training. This area was left broad because we think any of the listed criteria would define music as an inner resource for enhanced coping.

Perceptions of surgical outcome in patients' responses were coded across 3 themes: (1) optimistic (belief and hope in returning to original baseline of functionality), (2) indifferent (neither hopeful nor cynical about results of surgery), and (3) pessimistic (belief that nothing will restore the quality of life that existed before the spinal condition).

The CAS helped us better understand the diversity and complexity of the pain experience. With use of this nonverbal form of expression, patients' reports of postoperative pain often included pain that otherwise had been perceived by patients as unrelated and therefore underreported.

Discussion

Our hospital has the unique capability of providing music therapy to postoperative and other hospitalized patients. In this study, we compared the impact of a structured postoperative music therapy program on spine patients relative to control patients who did not receive music therapy after spine surgery.

We found a significant benefit in VAS pain levels (>1 point) but no statistically significant differences in HADS Anxiety, HADS Depression, or TSK scores. Although a 2-point difference is usually considered clinically significant, the degree of change in the music group is notable for having been achieved by nonpharmacologic means with scant chance of adverse effects. We suspect the lack of significant change in HADS Anxiety, HADS Depression, and TSK scores is attributable to the narrow study window. Given the observational data from our pilot study[58] and ongoing results with spine patients,[32] it seems clear that both mood state and resilience in coping are enhanced through an ongoing relationship with music therapy.

The study of a population as vulnerable as patients recovering from spine surgery raises many issues for providers and researchers. Although it is worthwhile to determine the efficacy of integrative modalities in serving these patients, the request

Table 3. **Relationship With Music**

Significant Relationship
Listens to music at home with husband—patient attends concerts and enjoys music from the 1970s
Family has rich musical history—brother is an accomplished musician, and patient has a particular interest in blues
Patient has positive relationship with music therapy from witnessing positive impact at psychiatric unit (patient's place of employment)
Patient drums for relaxation at home and loves different kinds of music
Patient uses music for both relaxation and energizing effect
Patient loves all kinds of music—any particular genre—music motivates, relaxes, and "helps with migraines"
Patient's father and several male relatives played guitar often during patient's childhood—regularly listens to jazz, blues, and salsa, depending on mood
No Significant Relationship
"Only playing the plastic recorder in grade school"
Patient studied guitar and piano to complete a required college course and is "doing well with guitar" yet finds no significant enjoyment in it
"None"
Patient has no prior musical training—reports being "tone deaf" despite the fact that husband is a music producer

Table 4. **Current Beliefs/Perspectives About Surgery**

Optimistic
Patient understands surgery is a quality-of-life decision and elects to have surgery
Patient has a "stick-to-it" attitude that will help [him] through recovery
"I feel better already—I needed this surgery"
Indifferent
Spinal injury was the result of an accident: "It was life"
Patient has had "so many ineffective surgeries" that there are no expectations or hopes
Patient believes "it will be a long road before feeling better"
Pessimistic
"Surgery is going to hinder everyday life and activities—for example, going to the gym—and I won't be able to do the things I used to"
Patient feels there is "no choice but to have the surgery now"—does not expect to resume same quality of life
"I am out of my mind to have the surgery—I should've gotten more opinions—this surgery may not be my last"
Patient is anxious and scared about inability to stand up or do anything on his own

for participation in a protocol at such a vulnerable time was often resisted. During our pilot work, it became clear that the ability of potential subjects to comprehend and complete protocol surveys was impacted by adverse effects, including sedation drowsiness; respiratory depression; nausea and vomiting; pruritus; and urinary retention caused by the medications used for postoperative pain management. Consequently, after piloting 5 cases before the main study, we extended the enrollment window to 72 hours.

Other unforeseen intrinsic or external obstacles were identified: Patient-related issues—including availability, level of interest in participation, and

inability to participate because of the medication adverse effects mentioned.

Staff investment/education—addressed over the first 3 study years with several in-services, starting with the surgical team and continuing with nursing and support staff in various combinations. These meetings led to the creation of an Institutional Review Board (IRB) approved educational sheet for inclusion in the information packet given to surgical patients on registration.

Programming interruptions—caused by the convergence of several unanticipated factors, including a delay in expedited review of the IRB renewal during the year of Hurricane Sandy and an interruption in the spine team's service for administrative and program modification.

Conclusion

Music therapy interventions (eg, use of patient-preferred live music) offered within a therapeutic relationship favorably affected pain perceptions in patients recovering from spine surgery. This effect was achieved through several therapeutic entry points, including support of expression and opportunities for emotional catharsis.

At the core of music therapy's efficacy is individualized treatment, through which patients are supported in their recovery of "self." Measurable benefits—including increased comfort; reduced pain; improved gait; increased range of motion, endurance, and ability to relax; and empowerment to actively participate in one's own care through daily activities imbued with an enhanced sense of agency—are of cardinal importance, as they may lead to quicker recovery perceptions and enhanced quality of life.

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Appendix

Spine Study: Data Collection Form

Name: _____ Date of admission: _____

MR#: _____ Enrollment date: _____

Age: _____ Length of treatment: _____

Referred by: _____

Past hospitalizations/dates: _____

_____

Medications: _____

_____

_____

Family history:

_____

_____

_____

Prior musical experience:

_____

_____

_____

Prior injury/trauma:

_____

_____

_____

Current beliefs/perspectives about treatment:

_____

_____

_____