Burn Pain and Anxiety: The Use of Music Relaxation During Rehabilitation

S. L. Ferguson, MSPT, K. V. Voll, OTR/L

Pain and anxiety are well-documented problems during the rehabilitation of patients with burns. This study examined the effect of music on anxiety and pain during range of motion. Eleven subjects with partial-thickness or deeper burns were randomly assigned to a control group (without music intervention) or experimental group (with music intervention). Vital signs, pain, and anxiety were recorded before and after treatments. There was no difference in pretest and posttest anxiety across the groups; however, there was a difference in anxiety between the groups. Conversely, there was a difference in pretest and posttest pain across the groups but no difference in pain between the groups. Results showed no significant reduction in anxiety and pain during therapy with music relaxation. Limitations included nonhomogenous groups, small sample size, potentially unrepresentative sample, variation in exercise protocol, and small musical selection. Further research is recommended. (J Burn Care Rehabil 2004;25:8–14)

Burn injuries are a major medical condition, often resulting in hospital admissions, surgeries, and extensive therapies. Patients with burns as their primary diagnosis comprise 700,000 emergency department visits and 45,000 hospitalizations in the United States per year.1 Occupational and physical therapists are actively involved in the treatment of patients who have sustained burns with the goals of achieving maximal physical and functional recovery. Burns are one of the most painful types of trauma,2 and pain management for this injury is a well-documented problem in all aspects of recovery.3,7 Specifically, pain control is a common obstacle limiting occupational and physical therapy treatments.8

Patients with burns experience “resting pain” secondary to tissue damage and “procedural pain” caused by interventions such as wound care and range-of-motion exercises.3,6,7 Although the latter type of pain is generally shorter in duration, it is greater in intensity.3,6 Management of this procedural pain is critical for optimal outcomes in therapy because range-of-motion exercises are essential in combating contractures and promoting functional use of the involved extremities. Opioid drugs are the primary pharmacological treatment for pain management of burn injuries,4,6 but they often do not provide complete alleviation of pain during therapeutic interventions.8,9 High doses of opioid drugs may also limit a patient’s ability to function.

In addition, repetition of these painful procedures often creates anticipatory anxiety for patients with burns.4,6,7 Research has demonstrated that anxiety and pain are interrelated3,5,7,10 and that an individual’s level of anxiety directly influences his or her perception of pain.5,7 This concept is supported by the gate control theory of pain, which states that there is a gating mechanism in the nervous system that can block the transmission of pain sensation at the level of the spinal cord.11 The gate control theory supports the use of music as a distraction from noxious input. For example, the gate control theory suggests that cognitive processes, such as relaxation, can exert control over painful stimuli.12 Additionally, anxiety creates a state of physiological stress arousal that is manifested by increased activation of the sympathetic nervous system.13 Literature shows that sympathetic nervous system activity can be effectively decreased through the use of relaxation music.14

Historically, music has been used in medical settings, such as hospital waiting rooms and dental offices, to promote relaxation;15 however, it has only been in recent years that researchers have examined
the use of therapeutic music in controlled environments for specific patient populations and procedures. Patients with cancer had decreased pain perception\textsuperscript{12} and patients with myocardial infarction had decreased anxiety\textsuperscript{16} with the use of music. Studies have also shown decreased anxiety for patients on ventilator support,\textsuperscript{13} during surgical procedures,\textsuperscript{14} and during flexible sigmoidoscopy.\textsuperscript{17} Literature suggests specific guidelines for the therapeutic use of music in medical settings. Musical selections should have a tempo between 60 and 80 beats per minute\textsuperscript{13,14,15} and a low pitch\textsuperscript{14,15}. The patient should choose the musical selection\textsuperscript{15,17-20} and volume.\textsuperscript{17,19,20}

Given the high levels of pain and anxiety experienced by patients with burns during rehabilitation, it has been theorized that a more comprehensive management should include not only opioid drugs but also adjunctive techniques, such as distraction.\textsuperscript{5,7} To date, little experimental research has been conducted on the use of music for patients with burns.

The purpose of this study was to determine the effects of relaxation music on levels of anxiety and perceived pain during range of motion exercises for patients with burns. It was hypothesized that there would be a statistically significant reduction in measured anxiety and perceived pain during range of motion therapy for patients with burns receiving music relaxation intervention as compared with those patients receiving no music intervention. If music relaxation is determined to be an effective adjunctive method of pain management, an inexpensive and therapeutic program can be developed that may improve tolerance for occupational and physical therapy and ultimately improve functional outcomes. Future research would then be indicated to assess the impact of the use of music relaxation on functional outcomes, length of hospital stay, quality of treatment, and the cost of hospitalization.

**METHODS**

**Sample**

All adult English-speaking patients admitted to the trauma service between January 2000 and January 2001 who had partial-thickness or deeper burns that crossed at least one major joint and who scored 100\% on the cognitive screening tool were asked to participate. The cognitive screening tool included categories on attention, memory, orientation, command following, and level of alertness. A score of 100\% was determined to be necessary to accurately complete testing and actively participate in the exercises. Eleven subjects met all criteria and consented to participate in the study (Table 1).

**Instrumentation**

**Pain.** The self-report visual analog scale was used for pain measurement (Figure 1). This scale has been found to be not only valid and reliable\textsuperscript{21-23} but also effective in measuring a change in pain level during a specific treatment.\textsuperscript{24}

**Anxiety.** The State-Trait Anxiety Inventory (STAI) was used to measure anxiety. It is a self-report instrument designed to measure both state (STAI-S) and trait anxiety (STAI-T) that consists of two scales. The “A-Trait,” or trait anxiety scale, evaluates an individual’s disposition to experience anxiety,\textsuperscript{10} and the “A-State,” or state anxiety scale, measures situation-related anxiety.\textsuperscript{10} The inventory is easy to score and possesses good validity and reliability.\textsuperscript{25,26}

**Vital Signs.** Vital signs of blood pressure, respiratory rate, and heart rate were taken before and after

<table>
<thead>
<tr>
<th>Table 1. Demographic summary</th>
<th>Control</th>
<th>Experimental</th>
<th>Percent</th>
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</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
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<tr>
<td>Male</td>
<td>4</td>
<td>4</td>
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</tr>
<tr>
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<td>81.8</td>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Flame</td>
<td>6</td>
<td>4</td>
<td>91</td>
</tr>
<tr>
<td>Steam</td>
<td>0</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>TBSA (%), mean</td>
<td>26.8, range 7–50, SD 17.1</td>
<td>14.4, range 12–15, SD 1.3</td>
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<tr>
<td>Number of joints, mean</td>
<td>3.8, range 1–6, SD 2.1</td>
<td>2.2, range 1–3, SD 0.8</td>
<td></td>
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<tr>
<td>Age (years), mean</td>
<td>38.3, range 18–57, SD 16.3</td>
<td>45.4, range 22–75, SD 19.3</td>
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</table>
treatment using standard techniques and equipment that met guidelines for standardization. For patients in the burn/trauma unit, vitals signs were measured by the Hewlett-Packard Component Monitoring System (Hewlett-Packard, Palo Alto, CA), and for patients in step-down units the Dinamap 8100 Portable Vital Signs Monitor (GE Medical Systems, Schenectady, NY) was used.

Procedure
Evaluations by the occupational and physical therapists were initiated upon consultation by the physician and were conducted in accordance with the guidelines established by the acute care rehabilitation department. After completion of the evaluations, consent was obtained from patients meeting the inclusion criteria and demographic information was gathered. Subjects were randomly assigned to an experimental group (with music intervention) or a control group (without music intervention). Subjects in both groups then completed the trait anxiety form.

Morning therapy sessions were scheduled before daily dressing changes. At the initiation and completion of each morning therapy session, specific testing was performed. Data were collected for pain and anxiety scores, heart rate, blood pressure, and respiratory rate. Additionally, length of range-of-motion treatment, music selection, and pain medications administered were recorded.

Patients in the experimental group chose a musical selection before each morning treatment session from a choice of six cassette tapes (Lifescapes series) that met guidelines for the therapeutic use of music in medial settings. Music was played during the range-of-motion exercises. The number of repetitions and type of exercise (active, active-assistive, or passive) were based on the needs of each patient. For both groups of patients, a controlled environment was created to minimize additional variables: treatment in the patient’s room with the door closed, a “research in progress—do not disturb” sign posted, minimal-to-no interruptions, lights turned on, and television turned off. Afternoon therapy sessions focused on functional activities, did not include music intervention, and were not included in the study.

Frequencies were computed to summarize the sex, ethnicity, and etiology of burn injuries. Tests ($\chi^2$) were used to assess potential differences in the distribution of these variables between treatment groups. Descriptive statistics were computed for interval and ratio level variables. Independent sample $t$-tests were computed to identify potential differences between treatment groups in STAI-T scores, age, length of treatment, TBSA, and number of joints involved. Repeated measures analysis of variances were calculated to compare pretest and posttreatment ratings for pain, anxiety, blood pressure, heart rate, and respiratory rate between the treatment and control groups. Pearson correlation coefficients were computed to examine the relationships between age and change in ratings of pain and anxiety and also between length of treatment session and change in ratings of pain and anxiety. Kendall’s tau b were computed to assess the relationship between gender and change in ratings of pain and anxiety. For all statistical analyses, a $P$ value of <.05 was considered to be statistically significant.

RESULTS
Many variables were examined to rule out potential differences between treatment and control subjects. Independent sample $t$-tests were computed to assess group differences based on trait anxiety (STAI-T) scores, age, length of treatment, TBSA, and number of joints involved (Table 2). No significant differences were found between the two groups based on length of treatment session ($P = 9.72, t = 4.81, df = 62$), trait anxiety scores ($P = .09, t = 1.92, df = 8$), or age ($P = .55, t = .62, df = 8$). There was a statistically significant difference between the two groups based on TBSA affected ($P = .00, t = 4.74, df = 10$, treatment group mean, 14.4%, range, 12–15, SD 1.34; control group mean, 26.8%, range, 7–50, SD 17.07) and number of joints involved ($P = .02, t = 2.72, df = 12$, treatment group mean, 2.2 joints, range, 1–3, SD 0.84; control group mean, 3.8 joints, range, 1–6, SD 2.14). Tests ($\chi^2$) were computed to assess group differences based on sex, ethnicity, etiology, and medication (premedicated vs not premedicated) (Table 3). There was no significant difference

Table 2. Group differences by $t$-test analysis

<table>
<thead>
<tr>
<th>Independent Sample</th>
<th>$t$-Test</th>
<th>Significance</th>
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<tr>
<td>Trait anxiety</td>
<td>$P = .09$ $t = 1.92$ $df = 8$</td>
<td>No</td>
</tr>
<tr>
<td>Age</td>
<td>$P = .55$ $t = .62$ $df = 8$</td>
<td>No</td>
</tr>
<tr>
<td>Length of session</td>
<td>$P = 9.72$ $t = 4.81$ $df = 62$</td>
<td>No</td>
</tr>
<tr>
<td>TBSA (%)</td>
<td>$P = .00$ $t = 4.74$ $df = 10$</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of joints</td>
<td>$P = .02$ $t = 2.72$ $df = 12$</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Figure 1. Pain visual analog scale.

No pain at all

The worst pain imaginable

$\chi^2$-tests were performed to assess potential differences in the distribution of these variables between treatment groups.
based on medication (P = .40, treatment group: 42% no medication, 31% premedication, 27% patient-controlled analgesia; control group: 56% no medication, 29% premedication, 15% patient-controlled analgesia). However, there was a statistically significant difference between the two groups based on sex (P = .00, treatment group: 92% male and 8% female; control group: 46% male and 54% female), ethnicity (P = .00, treatment group: 58% African American and 42% Caucasian; control group: 100% Caucasian), and etiology (P = .00, treatment group: 69% flame and 31% steam; control group 100% flame).

Repeated-measures mixed analysis of variances were computed to compare pretreatment and post-treatment ratings of pain, state anxiety, blood pressure, heart rate, and respiratory rate between the experimental and control groups (Table 4). Results were computed for both across-group and between-group effects. First, the results were analyzed for significance across groups to look for differences in pretest and posttest scores within each group of subjects. There were statistically significant differences between pretreatment and posttreatment ratings for pain (P = .04, F = 4.22, df = 1) and respiratory rate (P = .002, F = 10.91, df = 1) across the groups. Subjects in both the control and experimental groups demonstrated a statistically significant increase in posttreatment pain and respiratory rate as compared with pretreatment scores. There were no statistically significant differences between pretreatment and posttreatment ratings for heart rate (P = .27, F = 1.27, df = 1), systolic blood pressure (P = .27, F = 1.23, df = 1), diastolic blood pressure (P = .75, F = .11, df = 1), or state anxiety (P = .94, F = .01, df = 1) across the groups. Next, the results were analyzed for significance between groups to look for differences overall between each group of subjects. There was a statistically significant difference between the two groups based on state anxiety (P = .04, F = 4.47, df = 1). The mean pretreatment and posttreatment state anxiety scores for the control group were greater than those for the experimental group. There were no statistically significant differences between the two groups based on ratings of pain (P = .38, F = .79, df = 1), heart rate (P = .29, F = 1.13, df = 1), respiratory rate (P = .54, F = .38, df = 1), systolic blood pressure (P = .30, F = 1.12, df = 1), or diastolic blood pressure (P = .84, F = .04, df = 1).

Further analysis included correlations to examine relationships between variables. Pearson correlation coefficients indicated no significant relationship between age and change in pain (r = -.27), age and change in state anxiety (r = -.20), length of treatment session and change in pain (r = .09), or length of treatment and change in state anxiety (r = .01). Kendall’s tau b indicated no significant relationship between sex and change in pain (r = .01) or sex and change in state anxiety (r = -.11; Table 5).

**DISCUSSION**

In recent years, researchers have examined the effects of therapeutic music on pain and/or anxiety in specific patient populations and during procedures. Because of the limited research on the use of music in patients with burns and the well-documented problems of pain and anxiety during rehabilitation for these patients, this study was undertaken to determine the effect of relaxation music on perceived levels of pain and anxiety during range of motion exercises. The results did not indicate any statistically significant reduction in anxiety or pain during range of motion therapy for patients with burns receiving music relax-
ation intervention as compared with those patients receiving no music intervention.

Data analysis indicated that each group experienced a change in the level of perceived pain as well as a change in respiratory rate, but it did not indicate a change across the groups for heart rate, blood pressure, or state anxiety (Figures 2–4). Subjects in both the experimental and control groups experienced an increase in respiratory rate and perceived pain with range of motion without a change in anxiety. When examining differences between groups, it was noted that although there was no difference between the experimental and control groups for pain and vital signs, there was a significant difference for anxiety. Although the change in anxiety was not significant across the groups, the difference was significant between the two groups. It was noted that the experimental group experienced less anxiety than the control group (Figure 4). Results of the correlations revealed that the change in pain and change in anxiety scores were not related to age, sex, or length of treatment.

Several limitations to this study have been identified that included a difference in group characteristics, a small sample size, a potentially unrepresentative sample, a small musical selection, a variation in exercise protocol, and the implementation of a new burn pathway which limited the number of appropriate subjects. A combination of these factors may have affected the results. Despite careful study design and random assignment of subjects, it was found that the two groups of subjects were not homogenous with respect to TBSA, number of joints involved, sex, ethnicity, or etiology. They were, however, similar based on age, medication, length of treatment, and trait anxiety. The small sample size affected these results. The two characteristics that were controlled through the study design were length of treatment session and premedication, which were similar between the two groups.

These differences were at least in part the result of a small sample size. There were 64 burn admissions with a greater than 48-hour length of stay during the time of the study (Sentara Norfolk General Hospital Burn/Trauma Service, Norfolk, VA). However, many patients were excluded based on cognitive status and lack of joint involvement. A large portion of
potential subjects did not demonstrate the ability to participate because of a medical need for sedation. Additionally, a small percentage of potential subjects required immediate surgical management of their injuries, which excluded them from participating in the study. This small sample size limited the significance of our results and the ability to generalize the results to the national burn population.

Although this sample was comparable with the national statistics for proportion of male and Caucasian patients, this study indicated greater TBSA involvement that may not be representative of the burn population as a whole.1 The average size of a burn injury for patients admitted to a burn center is 13.4% TBSA nationally, 33 whereas this study’s sample yielded a mean of 21% TBSA. These characteristics of the sample may have limited the ability to generalize the results.

The authors also limited the musical selection to six cassette tapes that were characterized as relaxing in nature. Review of other medical research showed no standard technique for the amount of musical selection provided. All studies reviewed except one allowed the patient to choose their selection from the available options.13,14,18,20,26,27 Of the studies that documented the number of musical selections provided, the choices ranged from 4 to 50.13,14,18,20,26,27 This study’s offering of six tapes fell within the range of music provided in other research. Although no complaints were voiced, enabling the patient to listen to his or her own selection may have impacted the level of relaxation and subsequently the levels of pain and anxiety.

The authors did not standardize the number of repetitions of each exercise or the type of exercise performed to allow the needs of each patient to be met. This variability may have impacted the level of pain and anxiety experienced.

During the course of this study, the hospital implemented the use of a new burn dressing that required immobilization of the involved extremity for 24 to 48 hours, thus reducing the need for early therapeutic intervention. This drastically limited the number of potential participants and resulted in termination of this study.

Despite these limitations, this study has sound theory and suggests an adjunctive treatment approach that may be beneficial in the rehabilitation of patients with burns. This study would be worthy of duplication and further exploration.

CONCLUSIONS

The results of this research indicated that there was not a statistically significant reduction in anxiety and pain during range of motion therapy for patients with burns receiving music relaxation intervention as compared with those patients receiving no music intervention. However, further research in this area is recommended in facilities with the potential for a larger sample size.

REFERENCES

22. Deloach L, Higgins M, Caplan A, Stiff J. The visual analogue scale in immediate post-op pain: intra subject variability and


