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The Effects of Patient Preferred Recorded Music versus Nonmusic on the Progress of Physical Rehabilitation in Sports Medicine

Sarah Elizabeth Piercy
THE EFFECTS OF PATIENT PREFERRED RECORDED MUSIC VERSUS NONMUSIC ON THE PROGRESS OF PHYSICAL REHABILITATION IN SPORTS MEDICINE

By

SARAH ELIZABETH PIERCY

A Thesis submitted to the College of Music in partial fulfillment of the requirements for the degree of Master of Music

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The members of the committee approve the thesis of Sarah Piercy, defended on April 7, 2008.

________________________
Jayne Standley
Professor Directing Thesis

________________________
Alice-Ann Darrow
Committee Member

________________________
Dianne Gregory
Committee Member

The Office of Graduate Studies has verified and approved the above named committee members.
# TABLE OF CONTENTS

List of Tables  .................................................................................................................. iv  
Abstract  .......................................................................................................................... 1  

1. REVIEW OF LITERATURE  ................................................................. 2  

2. METHOD ................................................................................................. 15  
   Subjects and Setting ...................................................................................... 15  
   Design ........................................................................................................... 16  
   Procedure ...................................................................................................... 17  

3. DATA ANALYSIS ............................................................................... 19  
   Heart Rate ..................................................................................................... 19  
   Pain Perception ............................................................................................. 19  
   Total Exercise Capacity ............................................................................... 21  

4. DISCUSSION ......................................................................................... 23  

APPENDIX A .......................................................................................... 26  
   Human Subjects Approval  

APPENDIX B .......................................................................................... 27  
   Human Subjects Consent Forms  

APPENDIX C .......................................................................................... 36  
   Likert Pain Rating Scale  

REFERENCES ......................................................................................... 37  

BIOGRAPHICAL SKETCH ................................................................. 42
LIST OF TABLES

Table 1: Experimental Group Subject Demographics ..................................16
Table 2: Control Group Subject Demographics ...........................................16
Table 3: Mean Heart Rate Scores ...............................................................19
Table 4: Mean Pain Perception Scores ......................................................20
Table 5: Mean Total Exercise Capacity Scores ..........................................21
ABSTRACT

The purpose of this study was to examine the effects of preferred recorded music on heart rate, perceived pain and total exercise capacity during regular physical therapy exercises prescribed for sports related injuries. Subjects included 16 male and 10 female athletes who were referred by an orthopedic surgeon for Physical Therapy at the Tallahassee Orthopedic Sports Physical Therapy Clinic. Participants were randomly assigned into two groups, (a) physical therapy with music, and (b) physical therapy without music. A two-sample, independent method of measurement was used. Pre-tests were completed on visit one and post-tests completed on visit four. Music was not used with any subject on visit one. Baseline measurements of each variable were recorded and subjects were randomly assigned to either the music group or the control group. The control group exercised for three sessions without music. The experimental group exercised for three sessions with music. The investigator returned on the fourth visit to record final measurements of heart rate, pain perception and total exercise capacity. Differences in post-test data between groups were then compared using the Mann-Whitney U Test. Results indicated no significant differences between groups; however, mean scores for post-test data show that subjects in the music group experienced similar heart rate averages, less pain and a greater increase in total capacity of exercise. Subject’s verbal feedback indicated that music during exercise increased exercise enjoyment. Only two out of the 26 participants stated that music was not part of their regular exercise routine.
The advancement of health has, for centuries, been of great concern in many societies across the world. Physical and psychological well-being has been addressed through a variety of means, including medicine, music, art, dance and religion. The practice of using music in healing can be traced back to ancient African, Indian, Hebrew, Chinese, Greek and Roman civilizations. Ancient medicine men, called *shamen*, used music, art and dance coupled with religion as their primary source of healing. After many years of practice, music finally became a documented source of alternative treatment in health care during the mid-eighteenth century when other physical and mental health care professionals in the United States began encouraging the use of music in medical journals. From these first appearances of documented research in music has sprung a wide-spread American Music Therapy Association which dedicates its time to the improvement and expansion of Music Therapy practice around the world (Peters, 2000).

Through the use of systematic empirical designs to study the effects of music on physical, psychological, behavioral and spiritual well-being, Music Therapy has been proven to be an effective alternative treatment in medicine. Music has been shown to have a positive effect on a variety of physical, psychological and behavioral aspects of human existence. Some of the physiological factors studied include heart rate, blood pressure, respiration rate and pulse. A few examples of psychological factors influenced by music include increasing mood, affect, spiritual comfort and quality of life. Music Therapists have worked in many populations in an attempt to improve health in one or more of these areas. Peters (2000) gives a detailed summary of current Music Therapy practices in different types of populations, involving the therapeutic use of music with individuals who have mental or physical disabilities, learning disabilities, hearing impairments, visual impairments, orthopedic impairments, communication disorders,
autism, behavioral and emotional disorders and severe multiple disabilities. Peters (2000) also summarizes music therapy practice in medical treatment settings, physical rehabilitation settings, school settings and with individuals who are elderly, terminally ill or who are members of the general population interested in wellness. For purposes of the present study, Music Therapy practice in medical, orthopedic and physical rehabilitation settings will be discussed in detail, along with specific physiological and behavioral factors that encompass such practice in these populations.

“Physical rehabilitation programs work on restoring functional abilities in the areas of cognition, communication, physical skills, activities of daily living, and psychosocial skills to individuals who have injuries or illnesses that have caused physical, cognitive, sensory, and/or perceptual deficits” (Peters, 2000). Music for physical rehabilitation has been researched and documented over the past sixty years. Dr. Myra Staum, (2000) completed a literature review of this research. Her review revealed that a total of 135 case reports and experimental studies on music for physical rehabilitation were done between 1950 and 1999. Out of those, 12 were completed in a physical therapy clinic setting. Other therapeutic settings that involved the most amount of research in this field were general hospitals, state hospitals, public schools, comprehensive rehabilitation centers and nursing/retirement facilities. In addition to these findings, it is important to note her discovery of frequently referenced uses of music within this population. In this analysis, music was used to enhance motor coordination, improve muscular and joint strength, provide structure for mobility, stimulate muscular movement, increase muscular tone and endurance, induce relaxation, improve balance and posture, aid locomotion and the development of neuromotor patterns, decrease respiration and increase range of motion. A final note worth making, that is relevant to the study at hand, is that out of the 185 types of musical applications used in these studies, 72.15% used passive music listening.

In a more recent, 2005, meta-analysis completed by Paula Chandra, existing research on the effects of sound stimuli on the rehabilitation of upper and lower limbs
was evaluated. Two analyses were completed on seventeen studies that were located in the literature. Chandra found that in the past, music has been proven to be significantly effective on neurologic rehabilitation of the limbs.

Another study completed by Amy Kendelhardt in 2003 found significant difference in perceived pain and anxiety and an increase in exercise duration for physical therapy patients in an extended care rehabilitation facility. Subjects receiving physical therapy for a variety of conditions completed regular PT visits with or without live music. Negative verbalization frequency and perceived pain and anxiety, along with rehabilitation levels were measured. Pain, anxiety and exercise duration were positively affected by music and the need for further research was supported by this study.

A third study by Greig in 1996, researched the effects of background music on the responses of college athletes in a strenuous weight training program. This study used a regularly played radio station as the control music and a variety of other background music genres as the experimental music. Data collected on individual preference for background music, exercise motivation and individual recall of the type of music played during weight training sessions showed no significant differences. Noted difference in on-task behavior in relation to music preference was made, however, stating a statistically significant negative correlation was found between group preference for background music and group on-task behaviors in weight training. Greig proposed that more research is needed to assess the importance of increases in immediate on-task behavior versus increases in long-term motivation, in relation to the success of athletic weight training, as measured by coaches and individual athletes.

Physiological and behavioral factors that play a part in the rehabilitation of the human body respond to music. Such factors include heart rate, pain perception, exercise capacity and rhythm effects on gait characteristics. The investigator of the present study completed a thorough review of articles published in the *Journal of Music Therapy* between 1964 and 2007, revealed that out of the 815 published articles, 52 studies referenced heart rate, pain perception, exercise capacity and gait characteristics. In other words, only 6.38% of published articles in the *Journal of Music Therapy* studied the effects of music on one of those four variables. A closer look showed that out of that
6.38%, 16 articles (30.78%) referred to heart rate; another set of 16 articles referred to pain perception, yet one more set of 16 articles referred to gait characteristics and finally, 4 articles (7.69%) made reference to exercise capacity. A detailed discussion of these studies follows.

Among the various physiological responses studied, research on heart rate is the most inconsistent. This may be due to failure to control variables associated with fluctuations in heart rate, unsuccessful matching of musical stimuli to beat patterns or disinterest in activity along with other unknown variables that may have an influence on heart rate (Iwanaga and Moroki, 1999; Metzger, 2004; Standley, 2000). In 2004, Metzger assessed the use of music by patients participating in cardiac rehabilitation. It was found that music was used to modulate heart health, as measured by heart rate and blood pressure, as well as, to relieve stress and enhance exercise. Metzger made note that better development of music programs for cardiac rehabilitation is needed. Standley, in 2000 completed a meta-analysis of music research in medical treatment. Literature relevant to this analysis indicated that heart rate is one of the most inconsistent responses measured, and more education is needed to better understand how to control music stimuli to positively affect heart rate in patients. Similarly, Iwanaga and Moroki proposed that insufficient control of music stimuli may be to blame for research inconsistencies regarding heart rate. In this 1999 study, subjective and physiological responses to music evaluated by preference and activity showed no significant differences. Heart rates increased with excitative music and preference showed no effect on response rates.

The 16 Journal of Music Therapy articles found that measured the effects of music on heart rate also produced inconsistent results. No significant difference in change of heart rate was found by Baryza and Whitehead-Pleaux in their 2006 study measuring the effects of music on pediatric burn patients’ anxiety during dressing change. Live music versus verbal instruction were measured via psychological, behavioral and physiological tests. Results were mixed and inconclusive. A 2007 study by Ferrer also found inconclusive results. This particular study measured the effects of live music on decreasing anxiety in patients undergoing chemotherapy treatment.
Behavioral questionnaires, heart rate and blood pressure were recorded in pre and post-tests before and after treatment. Patients listened to twenty minutes of preferred live music during treatment in an attempt to decrease variables. No significant difference for heart rate was found but anxiety was reported to have decreased and an overall increase in patients’ quality of life was found. Heart rate responses of one-day-old infants to music decibel levels was researched by Dureau in 2005. Infants listened to 21 minutes of music at 3 loudness levels with 3 minutes of silence. No significant difference in heart rate response was found. Another study measuring response rates of infants was completed by Diefendorf, Lorch, Lorch and Earl in 1995. The effects of stimulative and sedative music on systolic blood pressure, respiration and heart rate in premature infants was researched using 10 minutes of music intervention mixed with 10 minutes of rest. Results indicated that although heart rate responses were more varied during sedative than excitative music, no significant difference was shown. A fifth study showing inconsistent heart rate response was conducted in 1991. Standley measured the effects of vibrotactile and auditory stimulation on college students’ perceptions of comfort, heart rate, and peripheral finger temperature. Neither music nor vibrotactile stimuli produced significant results, yet heart rate was affected most by the sequence of stimuli across time. Two earlier studies by Davis and Thaut in 1989 and Barger in 1979, also produced mixed results. When measuring heart rate and perceived anxiety with preferred relaxing music, Davis and Thaut found that although relaxing music increased self-reported relaxation and decreased anxiety, physiological responses such as heart rate were not supportive of this data. Similarly, when measuring the effects of music and verbal suggestion on heart rate and self-report of arousal, Barger was unable to produce significant results between conditions. In contrast, noteworthy significant difference was found in six of the other Journal of Music Therapy studies that referenced physiological response rates.

The earliest of these, completed by Amy Beckett in 1990, measured physiological recovery heart rates in distance. Subjects in this case were placed into one of three walking groups. Each subject’s heart rate was measured by a stop watch and wrist
pulse before and after walking for 30 minutes with either no music, continuous music or intermittent music. A portable AM/FM radio provided preferred musical stimuli during this experiment. Subjects who walked with continuous music were able to recover baseline heart rates faster than subjects in other groups. In a different study, completed in 1996 by Matejek, Miluk-kolas and Stupnicki, which similarly measured recovery heart rates of adult patients awaiting surgery, pre and post-test heart rate measurements via an electronic device (Norelco, model HC2901), revealed that subjects who listened to music pre-surgery were able to return to normal heart rates after one hour while subjects’ heart rates in the non-music group remained raised.

Decreasing heart rate was positively linked to the use of sedative music listening in another 1996 study conducted by Iwanaga, Ikeda and Iwaki. Here, heart rates were measured by a NEC San-eipolygraph 360 system and recorded by a digital data recorder. A 3-way ANOVA of results showed that heart rate did not change during excitative music and significantly decreased during sedative music. Another study completed in 1995 by Cassidy and Standley, investigating the effects of music listening on physiological responses was performed on premature infants in the NICU. Music showed positive effects on heart rate, as measured by a Dyna Scope DS 3300 monitor.

More recent studies showing positive effects of music on heart rate include one done by Knight and Rickard in 2001, measuring heart rate responses in healthy male and female adults. An experimentally induced stressor was applied to each subject. Heart rate data showed increases as a result of this stressor. Music in this study helped decrease heart rate. A final study completed in 2002, by Burns and Labbe, also looked at the effects of music on decreasing heart rates that were elevated due to induced stress. Significant differences were found here as well.

The inconsistencies in data results of these 16 studies provide evidence that more carefully controlled research and education about heart rate beat patterns and variables that may affect these beat patterns is needed. More in-depth items may need to be considered when measuring heart rate, such as, increased individualization of ascertaining stable heart rate. Investigators need to carefully observe and record baseline data repetitively before introducing musical stimuli, in order to better understand each
subject’s beat patterns and to be better equipped at matching music to these individual differences. The few studies marking differences in excitative versus sedative music are also important and can be repeated in a number of situations in order for Music Therapists to fully understand the effects music can have on such physiological responses.

In addition to heart rate, pain perception is another variable that has been researched in the music literature. Results of this research are also varied, however, not quite as inconsistent as those measuring heart rate response. Out of the 16 studies found, three revealed no significant differences. Kim and Koh, 2005; Curtis, 1986 and Noquchi, 2006. Kim and Koh, in their study of the effects of music on pain perception of stroke patients during upper extremity joint exercise, revealed no significant difference in self-reported pain across music conditions. Conditions included no music, song and karaoke accompaniment. In 1986, Curtis studied the effects of music on pain relief and relaxation of the terminally ill. Conditions also included no music, background music and no intervention. Similarly, patients’ self-report of pain showed no significant difference. The effects of music versus non-music on behavioral signs of distress and self-report of pain in pediatric injection patients was researched in 2006 by Noquchi. In this study, no significant difference in pain rating was found; however, across time patients reported that music made a difference when the number of injections increased. The remaining studies, with the exception of one involving analysis of assessment of pain, proved music to be a significant factor in decreasing pain perception.

Early studies linking positive effects of music on decreasing pain perception involved a 1978 study by Wolfe, where patients’ self-report of pain during group exercise showed more positive statements with the use of music listening. In 1985, Rider also used self-report measures in response to music listening to evaluate the effects of music in pain reduction, muscle relaxation and entrainment mechanisms. This study used three types of music coupled with imagery to measure such effects. It showed that the entrainment music selections were most effective.

Pain rating scales are popular assessment tools in health professions across America. There are numerous types of pain rating scales, some of which are referenced
in the literature. A 1992 study by Davis, used an Over Pain Reaction Rating Scale, consisting of 11 behavioral observations of affect such as eye brow raises, to measure patient’s pain. Subjects in this study listened to individually chosen music over a headset after having been given relaxation instruction prior to gynecological procedures. Analysis of subject’s self-report along with rating scale scores revealed that pain was significantly reduced with the use of music listening. Another study which used a pain rating scale and music listening to study the effects of music on pain reduction was conducted by MacDonald and Mitchell in 2006. The investigators in this study experimentally induced cold pressure pain in healthy adults to measure the effects of white noise, relaxation music and recorded music on tolerance of pain. The Visual Analog Scale and McGill Pain Questionnaire were used to measure subjects’ perceived pain. Results revealed that listening to preferred music over the other stimuli increased perceived control and tolerance of pain.

A final study measuring the effects of music listening on perceived pain as measured by a pain rating scale was done in 2006 by Clark, Isaacks-Downton and Wells. This particular study used self-selected music recorded on a cassette player with patients undergoing radiation therapy. Results from the Pain Numeric Rating Scale which consists of a rating from 0-10, showed that over time, symptoms of pain decreased in both music and non-music groups; however, a correlation between the number of times music was used and greater decline in symptoms was found.

The previous studies examined the effects of music listening on perceived pain. The following two studies that showed significant results with the use of music took the music stimuli a step further and studied the effects of music listening versus live music on the decrease of pain. In 1996, Boldt used live and recorded music during range of motion and aerobic exercise, as well as, progressive relaxation exercise for bone marrow transplant patients. Self-report, pain questionnaires and a behavioral observation scale were used to measure pain perception. Long term effects proved that both live and recorded music increased overall pain reduction. Similarly, the 2004 study by Faunce & Kenny, measured the effects of pain reduction via pain questionnaires and a pain rating self-report scale. Group singing and music listening were compared between groups.
attending a multidisciplinary chronic pain clinic. A one-way ANCOVA revealed significant difference in the use of both types of music in pain reduction.

One final article found in the 2007 issue of the *Journal of Music Therapy*, by Groen, analyzed assessment and treatment practices of Music Therapists and nursing professionals working in Hospice. A survey revealed that numerical rating scales and the FACES pain scale were most commonly used among both professions. This can be an important factor when consulting with other professionals about the pain clients are experiencing.

The analysis, development and implementation of easy to use assessment tools to measure treatment outcome is an important part of working as a Music Therapist, as well as, conducting research to further the profession. Gregory, (2000) compiled a summary of the test instruments used by *Journal of Music Therapy* authors between 1984 and 1997. Each instrument was placed in one of three groups; unpublished, published and researcher-constructed. This study is an example of how Music Therapists can assess previously used instruments and either choose from old tools or develop new tools to fit the needs of a client or setting. Gregory’s study did not include physiological measures, behavioral observations, computerized devices or self-report. An earlier article, by Sutton, (1984) gives an example of the development and implementation of a specific Music Therapy Physiological Measures Test. With the help of a Physical Therapist, the Music Therapist developed a test to measure gross and fine motor movements required for performance on piano, organ, classical guitar and drum set. The Physical Therapist then conducted a different assessment using another test instrument. Outcomes for both instruments were compared, to reveal that the newly developed Music Therapy Physiological Measures Test was reliable, valid and easy to administer.

In Physical Therapy settings, treatment is very individualized due to the unique nature of each injury, illness or disorder. Assessment instruments need to be task oriented and based on individual functional ability. A 1985 study by Cofrancesco, conducted in a rehabilitation setting looked at the effects Music Therapy had on hand grasp strength and functional task performance in stroke patients. Functional task movements, coordination, bilateral movements and grasp strength were assessment
specific to each subject’s ability. The Music Therapist manipulated playing different instruments to increase each subject’s specific goals. Results proved Music Therapy as a beneficial treatment modality.

Along with individualizing test instruments, Music Therapy research states that individualizing the type of music used is vital to the success of Music Therapy. Leiderman (1967) stated in his article that music should be familiar when working with geriatric patients. Then, in a 1984 study, Stratton and Zalanowski found that the degree of music liking was the most important factor in relaxation. One of the only studies found that did not show a significant difference in musical preference versus investigator chosen music, was a 1993 study where Davis and Thaut selected music for relaxation based on the notion that it had sedative qualities. In this particular study, all subjects achieved relaxation regardless of preference.

When surveying young adults, Gfeller (1988) found that rock, pop and new wave music was most preferred for use with aerobic fitness and that components most effective on helping pacing, strength and endurance, as well as, on increasing mental attitude about activity were style, tempo, rhythm and extra musical associations. Research in the use of music with gait disorders has shown that matching these elements of music stimuli to a clients physical elements can increase the progress of rehabilitation.

Staum (1983) proved in her study of rhythmic stimulation in the rehabilitation of gait disorders, that individually determined music and rhythmic percussive sounds matched to the footsteps of subjects helped improve walking and consistencies in walking speed. Clair and O’Konski (2006) studied a few more gait characteristics with the use of Rhythmic Auditory Stimulation (RAS). No significant difference for cadence, velocity and stride length were shown, however, subjects needed less assistance with musical stimuli than without. Again, the musical stimuli was matched and embedded into each client’s regular routine.

Stride length and velocity were again researched by Kwak (2007). Rhythmic Auditory Stimulation did prove to have a significant difference in treatment of the subjects in this study. In particular, Kwak noted that a strong emphasis on beat is needed, stating that use of a drum with prescribed music was very effective in helping cadence.
Other factors such as social supports, psychological well-being and enjoyment of exercise also influenced the way in which this population of individuals with Cerebral Palsy adhered to the program.

Kwak was not the only one to make it known that enjoyment of exercise is an influential factor in rate of recovery and adherence to a program. Pargman and Wininger (2003) conducted an assessment of factors associated with exercise enjoyment. It was found that music enjoyment accounted for the highest percentage of those four, equaling 21%. Music was also shown to help improve enjoyment of an Occupational Therapy program or hand rehabilitation by Zelazny (2001). In another 2001 study, Clair, Johnson and Otto tried to provide significant difference in the enhancement and adherence to physical rehabilitation through the use of preferred music. Live, instrumental, vocal and no music were used over a series of two sessions. Patient reports revealed that having music was liked more than having no music; however, no significant difference was shown for adherence to the physical rehabilitation program. Additional research is needed to provide a better case for the use of music to increase enjoyment of, and adherence to, rehabilitation programs.

A final variable researched in the *Journal of Music Therapy* articles deals with the behavioral analysis of exercise capacity. It is important to note that although no research has specifically proven this to be true, the present study showed that exercise capacity could possibly be correlated with enjoyment and adherence as related to the use of music. More structured research is needed to study the association of exercise capacity and enjoyment. The four *Journal of Music Therapy* articles that cited exercise capacity measured with and without the use of music showed mixed results. Clair, Cochran, Johnson and Otto (1999) studied duration in seconds of on-task behaviors of elderly clients participating in an exercise rehabilitation program with and without music with no significant differences found. Somewhat similar to the above study, Kuhn, Sims and Shehan (1981) studied exercise capacity in seconds that subjects listened to preferred music versus non-preferred music. It was evident by the results of this study that subjects listened to preferred music selections longer than those that were not preferred. In contrast, Davis and Thaut (1991) measured the exercise capacity of EMG activity in
triceps and bicep activity in response to matched versus slower rhythms with significant differences showing up for matched rhythmic stimuli. An earlier study by Thaut (1985) also studied motor proficiency in response to rhythmic stimuli. Here, surface contact of hands and feet of children with gross motor dysfunction was measured with auditory rhythm, rhythmic speech and no rhythmic stimuli. Subjects aided with rhythmic stimuli performed with significantly better accuracy than those without rhythmic stimuli.

It is evident from this analysis of studies on exercise capacity published in the *Journal of Music Therapy* between 1964 and 2007, that much more research is needed. If exercise capacity can be linked to exercise enjoyment and adherence to a program, Music Therapy could be an essential modality in rehabilitation settings. Sometimes rehab clients may or may not show up for every visit, resulting in slower progress and lower success rates.

Motivation can be another related factor in clients showing up on a continuing basis for scheduled visits. Measures of exercise motivation were researched in the *Journal of Psychology*. Day and Maltby (2001) grouped intrinsic and external motivational factors related to exercise. The research in this area had previously shown a relationship between psychological well-being and exercise motives. It was stated that extrinsic motives lead to stress while intrinsic motives such as enjoyment lead to stress relief. This research shows that music can increase exercise enjoyment.

Another study from the *Journal of Psychology* (Trafimow and Trafimow, 1998) that researched the intentions of back pain sufferers to exercise revealed that perceived difficulty and ability proved to be variables that best predicted intentions. If Physical Therapists can accurately predict the difficulty of exercise related to a client’s ability then Music Therapists may be able to structure a preferred music program to distract clients from perceived difficulty. Again, this is another area that can be researched. So far, all the research discussed has involved a variety of populations where pain, heart rate and exercise capacity are measurable variables affecting the progress of rehabilitation. Although sometimes inconsistent, the majority of the music literature
shows that Music Therapy can be beneficial in enhancing the therapy of individual’s needing physical rehabilitation. One population of interest, that has yet to be referenced in Music Therapy literature, is Sports Medicine. All of the same factors already researched and discussed are relevant to the rehabilitation of clients in this category of health care. In an article from the 2003 National Center for Injury Prevention and Control, Annest, Conn and Gilchrist state that an estimated 7 million Americans received medical attention for sports related injuries between 1997 and 1999. Out of these injuries, strains, sprains, neck and head injuries accounted for the majority of events. Physical rehabilitation is used in the majority of these cases. The US National Library of Medicine (Medline Plus, 2008) also quotes that strains and sprains along with knee injuries, swollen muscles, Achilles tendon pain along the shin bone, fractures and dislocations account for the majority of sports related injuries that need physical rehabilitation after injury. Research in this area may be able to open a new market up for Music Therapists in Sports Medicine, especially with professional athletes who need a high probability of success to get back into the game.
CHAPTER 2
METHOD

Subjects and Setting

Subjects consenting to participate in this study were clients at the Tallahassee Orthopedic Sports Physical Therapy Clinic (TOSPT), which is a locally owned clinic that has been in operation since 1988. TOSPT employs 19 physical and occupational therapists who specialize in orthopedic, sports and industrial rehabilitation. They provide many services to the public including physical therapy, sports medicine, massage therapy, occupational therapy, industrial rehabilitation, aquatic therapy and a fitness and wellness program. In connection with local middle school, high school and college coaches, care is provided for sports injury rehabilitation.

Criteria for inclusion in the present research included having been referred to TOSPT by an orthopedic surgeon for physical therapy (PT) to strengthen muscles damaged in a sports related injury. Subjects could be at any point in their physical therapy program as long as they had at least four PT visits left. The total number of clients was 26: 16 males and 10 females. Ages ranged from 15 to 33 and PT visits occurred either once or twice a week, lasting from 30 minutes to 1 hour. Sports related injuries included in this study are as follows; 11 anterior cruciate ligament (ACL) injuries, 7 back injuries, 5 shoulder injuries, 2 ankle injuries and 1 neck injury. See Tables 1 and 2 for subject demographics.

Design

The present study consisted of two groups and three dependent variables. Twenty-six participants were given pre and post-tests, on the first of four consecutive physical therapy visits, for heart rate and pain perception. Total exercise capacity was also recorded. Participants were then randomly assigned to either the control group (no music) or the experimental group (preferred recorded music) for the remaining three PT visits. Pre and post-tests for heart rate and pain perception were given again, along with a recording of exercise capacity on the fourth and final visit. The investigator used several
Table 1: *Experimental Group Subject Demographics*

<table>
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Table 2: *Control Group Subject Demographics*

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<td>F</td>
<td>23</td>
<td>ACL</td>
<td>1</td>
</tr>
</tbody>
</table>

devices for the recording of such data.

Heart rate, recorded at the beginning and end of visits one and four, was read by an Orion Scientific Heart Rate Monitor Model SZ 905. Participants strapped the monitor under their shirt and around their chest. A receiver, in the form of a wrist watch, was strapped around their wrist. The investigator asked each subject to state beginning and ending heart rates, as read from the receiver. The investigator confirmed subject’s response by checking heart rate shown on the wrist watch to increase reliability, and then recorded the data.
Pain perception was also recorded in pre and post-tests on visits one and four, however, subjects self-report was used as the measurement tool. A Likert Pain Rating Scale that is commonly used by patients and Physical Therapists at TOSPT was adopted for the measurement of subjects’ pain. This scale ranges from 0-10, 0 being no pain, 3 being tolerable pain, 5 being uncomfortable pain, 7 being intolerable pain and 10 being excruciating pain. Subjects were asked to rate their level of pain using this scale, at the beginning and end of visits one and four. The investigator repeated subjects’ self-report to ensure reliability and then recorded level of pain by hand.

The final variable measured was total exercise capacity. Exercises remained constant until visit four, when new exercises were added if the Physical Therapist noticed progress with exercises previously completed. The investigator recorded the total number of exercises completed on visits one and four. The number of new exercises added, if any, was also recorded on visit four. Exercise capacity between groups was then compared.

**Procedure**

The investigator called the physical therapist responsible for doing patient intake evaluations every morning to scan for possible study candidates, as well as, spoke with other physical therapists about clients already active in the program that might have been willing to participate. Candidates were then approached and asked to volunteer. After consenting to participate, subjects were randomly placed in the control group having no music during PT visits or the experimental group having preferred recorded music during PT visits. All participants completed the first of four visits with no music. Pre and post-tests measuring heart rate and pain perception were conducted and exercise capacity was recorded. This data served as a baseline for each individual. Following this first visit, subjects completed their next three consecutive PT visits in their respective groups.

Subjects placed in the control group completed their next three visits as usual, with no music. The investigator returned on the fourth visit and recorded pre and post-test data for heart rate and pain perception and also recorded total exercise capacity.

Subjects placed in the experimental group listed favorite songs, artists and music
genres for the investigator, who then compiled an individualized song list for each participant. These lists consisted of one hour of music, on a Generation II, Ipod Nano. Preferred music chosen, varied. Favorite genres used included rap, alternative, classic rock, country, show tunes and pop. On their next three visits, experimental group participants listened to their individualized song list by placing the Ipod in an exercise armband. Only one ear piece was used so that clients could communicate with their Physical Therapist during exercise. As with the control group, the investigator returned on the fourth visit to collect pre and post-test data for heart rate and pain perception and to record total exercise capacity.
CHAPTER 3
DATA ANALYSIS

Heart Rate

The Mann-Whitney U Test was used to compare post-test heart rate measures between and within groups on visits one and four. Table 3 refers to the mean scores found for each of these categories.

<table>
<thead>
<tr>
<th>Visit</th>
<th>Exp. Group</th>
<th>Control Group</th>
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<tr>
<td>Baseline</td>
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<td>110</td>
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<tr>
<td>Final</td>
<td>106.54</td>
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</table>

Results

Four Mann-Whitney U Tests were completed with heart rate response data. The first two tests compared baseline and final heart rate scores between groups to find if any differences existed prior to the implementation of music stimuli. Baseline results (n₁=13, n₂=13, U₁=72.5, U₂=96.5, α=.05) and post results (n₁=13, n₂=13, U₁=70, U₂=99, α=.05) showed no significant difference between groups. The third and fourth tests compared post-test heart rate scores within groups for visits one and four. Both experimental (n₁=13, n₂=13, U₁=53, U₂=116, α=.05) and control results (n₁=13, n₂=13, U₁=80.5, U₂=88.5, α=.05) revealed no significant differences for heart rate responses within groups between visits one and four. Although these tests did not show any statistically significant differences, the means for baseline and final heart rate scores, as shown in Table 3 indicate a greater decrease over time in mean heart rate for the experimental group than for the control group.

Pain Perception

The Mann-Whitney U Test was also used to compare pre/post perception of pain
measures between and within groups on visits one and four. Baseline pain scores were averaged and compared to find if any difference between groups existed before music was applied. Post-test pain scores for the final visit were then averaged and compared to find if any difference between groups existed after music was applied. Finally, the change in pain ratings between the first and fourth visits of subjects within each group was averaged and compared by group. Table 4 refers to the mean scores found for each of these categories.

<table>
<thead>
<tr>
<th></th>
<th>Visit</th>
<th>Exp. Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline (0-10)</td>
<td>2.39</td>
<td>1.62</td>
<td></td>
</tr>
<tr>
<td>Final (0-10)</td>
<td>0.77</td>
<td>1.38</td>
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</tr>
</tbody>
</table>

Results

Four Mann-Whitney U Tests were completed with pain perception data. The first two tests compared baseline and post pain scores between groups to find if any differences existed prior to the implementation of music stimuli. Results for baseline experimental ($n_1=13$, $n_2=13$, $U_1=69.5$, $U_2=99.5$, $\alpha=.05$) and control post measures ($n_1=13$, $n_2=13$, $U_1=89.5$, $U_2=79.5$, $\alpha=.05$) showed no significant differences. The third and fourth tests compared post-test pain perception scores within groups for visits one and four. Both experimental ($n_1=13$, $n_2=13$, $U_1=47$, $U_2=122$, $\alpha=.05$) and control group results ($n_1=13$, $n_2=13$, $U_1=68.5$, $U_2=100.5$, $\alpha=.05$) revealed no significant differences for pain perception within groups between visits one and four. Although these tests did not show any statistically significant differences, the means for baseline and final pain perception scores, as shown in Table 4, indicate a greater decrease over time in mean pain perception for the experimental group than for the control group.
Total Exercise Capacity

Exercise capacity between and within groups was also compared using the Mann-Whitney U Test. The number of exercises completed on visits one and four were recorded and analyzed. Post exercise capacity scores for visit one were averaged and compared to find if any difference between groups existed before music was applied. Post exercise capacity scores for the final visit were then averaged and compared to find if any difference between groups existed after music was applied. A comparison was then done within each group to find if any differences existed between the first and fourth visit. Finally, a comparison of the number of new exercises added on the fourth visit due to physical therapy progress was done between groups. Table 4 refers to the mean scores found.

<table>
<thead>
<tr>
<th>Visit</th>
<th>Exp. Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>6.85</td>
<td>7.77</td>
</tr>
<tr>
<td>Four</td>
<td>8.69</td>
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</table>

Results

Five Mann-Whitney U Tests were completed with exercise capacity data. The first two tests compared baseline and final exercise capacity scores between groups to find if any differences existed prior to the implementation of music stimuli. Results for baseline (n₁=13, n₂=13, U₁= 97, U₂=72, α=.05) and final capacity (n₁=13, n₂=13, U₁=83, U₂=86, α=.05) showed no significant differences between groups. The third and fourth tests compared total exercise capacity scores within groups for visits one and four. The experimental groups’ results (n₁=13, n₂=13, U₁=150, U₂=19, α=.05) indicated a significant difference in the progress of exercise capacity between visits one and four. The control group’s results, however, (n₁=13, n₂=13, U₁=117.5, U₂=51.5, α=.05) revealed no significant difference for the progress of exercise capacity between visits one and four. A final Mann-Whitney U Test comparing the number of new exercises added between
groups on visit four, \( n_1=13, n_2=13, U_1=61, U_2=108, \alpha=.05 \) revealed no significant difference between groups. Table 4, indicates that there was a greater increase in the total number of exercises added due to progress for the experimental group than for the control group.
The purpose of this study was to research the effects music has on physiological measurements of heart rate and pain perception, as well as the behavioral measurement of total exercise capacity. Results of the Mann-Whitney U tests completed indicated no significant difference for all three variables, with the exception of total exercise capacity for the experimental group. Various factors influenced the outcome of this study, all of which could be more effectively controlled in future studies.

One of the influential factors was the small sample size of the present study. The Physical Therapists at TOSPT are in high demand and are busy with old patients, new patients, referrals and evaluations on a daily basis. Effective subject intake procedures along with plenty of time are crucial to collecting a large enough sample to test, in order to produce less speculative and more thorough results.

Another factor that may have influenced the results of this study was the randomness of patient visits. Patients were either scheduled for one visit or two visits per week. Once scheduled, it was up to the patient to actually show up for their visit. Many times due to weather or personal issues, patients did not make their scheduled appointment and either rescheduled for an unusual day or just waited until the following week to return. Although subjects completed all four visits consecutively, the inconsistencies in time between visits may have had an effect on variables measured and should be controlled for in future studies.

Music could have also been more effectively controlled. The investigator attempted to match the order of subject selected songs to fit the exercises seen in visit one when recording baseline data. Sometimes the order, in which exercises were previously completed, had to change due to a busy exercise room where subjects had to share equipment. This change in routine could have caused a mismatch of music stimuli to exercise content, causing more variations in data observed. Live music was not able to be used at this facility because of the setup of the exercise floor. Future studies should
consider using a facility that has access to more than one exercise room where live music can be matched to changing exercise routines.

Heart rate has, in past studies, been inconsistent. The present study also produced inconsistent results for a number of reasons. The investigator found that heart rates between individuals varied so much that a comparison between groups yielded inconsistent results. When comparing heart rate responses, it may be necessary to compare subjects against themselves with and without music to identify any relational factors. Also, not only did heart rates vary between individuals, but they also varied between visits for each individual. Influential factors such as a person’s diet can influence heart rate. Such factors should be accounted for before attempting to draw any conclusions about heart rate response. The use of patient surveys on such factors, along with a number of trial pre-tests on heart rate responses could be done before music stimuli were implemented. Such careful control may help produce better results.

Yet another consideration involves the use of patient surveys regarding the preference of music versus non-music when exercising, in relation to motivation, general liking, degree of interest and perception of progress. Subjects in this study made several comments about the enjoyment of music during exercise, however, this was not surveyed for this particular study. Documenting such comments for comparison between groups and between individuals could further define differences found.

A final note involves the observation of exercise capacity. Upon gathering data regarding this variable, the investigator noticed that subjects in the music group tended to rest less than subjects in the non-music group. This was another variable overlooked by the design of this study, as total exercise capacity instead of rest time was being measured. Perhaps this variable could be researched in later studies.

As with all studies, more research is needed to support and expand the theories of previous literature. While the demand for Physical Therapy grows, the need for extra help and alternative therapies to enhance the goals of PT will also grow. If Music Therapists continue to study and document the benefits music has on physiological, psychological and behavioral factors involved in exercise and rehabilitation, the demand for Music Therapy as an integrated practice that coincides with Physical Therapy may
expand as well. Continuing education, experience and better research can help pave the
path to a wider job market for Music Therapists interested in physical rehabilitation,
faster recovery rates for patients and added treatment modalities to further the progress of
physical rehabilitation.
APPENDIX A

HUMAN SUBJECTS APPROVAL

Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8633 · FAX (850) 644-4392

APPROVAL MEMORANDUM

Date: 1/17/2008

To: Sarah Piercy
1251 Continental Court
Tallahassee, FL 32304

Dept.: MUSIC SCHOOL

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research
The Effects of Patient Preferred Recorded Music Versus No Music on the Progress of Physical Rehabilitation in Sports Related Injuries, as Measured by Heart Rate, Patient Perceived Pain, Duration and Diameter of Specific Exercises

The forms that you submitted to this office in regard to the use of human subjects in the proposal referenced above have been reviewed by the Human Subjects Committee at its meeting on 1/5/2008. Your project was approved by the Committee.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals which may be required.

If the project has not been completed by 1/3/2009 you must request renewed approval for continuation of the project.

You are advised that any change in protocol in this project must be approved by resubmission of the project to the Committee for approval. The principal investigator must promptly report, in writing, any unexpected problems causing risks to research subjects or others.

By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols of such investigations as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Protection from Research Risks. The Assurance Number is IRB00000446.

cc: Jayne Standley
HSC No. 2007.1043

26
APPENDIX B
HUMAN SUBJECTS CONSENT FORMS

Attention: Physical Therapists and Patients of TOSPT
From: Sarah Piercey, MT-BC, Graduate Music Therapy Student of Florida State University
Board Certified Music Therapist
Regarding: Music Therapy research at TOSPT

Attention Sports Injury Physical Therapy Patients of TOSPT:

My name is Sarah Piercey, MT-BC. I am a Graduate Music Therapy student at Florida State University, conducting research for my thesis, in partial completion of my graduate degree. I am also a Board Certified Music Therapist, meaning I have successfully completed an Undergraduate Music Therapy Degree, an American Music Therapy Association approved Internship, as well as, taken and passed my board exam to become a certified Music Therapist.

I am writing to request your participation in an exciting new research project being conducted at TOSPT. Owner, Kent Knisely and his team of Physical Therapists have approved my proposal to conduct Music Therapy research for my Graduate thesis work, here at Tallahassee Orthopedic Sports and Physical Therapy. The project title is "The Effects of Patient Preferred Recorded Music on the Progress of Physical Therapy with Sports Related Injuries, as Measured by, Patient's Perceived Pain, Heart Rate and Duration and Diameter of Specific Exercise". I have asked every Physical Therapist of TOSPT to give each sports injury patient this information sheet to collect participants for my study. I ask that you read this over and ask any question you may have pertaining to the study or to participation. If you decide that you would like to be a part of this exciting study, please contact me at (850) 322-0618 to ask questions and get started!

If participating, during your regular physical therapy visits at TOSPT, I will be measuring your pain, heart rate, duration in minutes of specific exercises and inches of gross and fine motor movement for specific exercises, with and without music. Participants will be randomly assigned to one of two groups. Group 1 will be continuing therapy as usual, without music while Group 2 will continue therapy with music. Music will be individualized to your own preferences and structured to fit your individualized therapy routine. Participants will listen to their specific playlist on an I-pod strapped to one arm, using only one earpiece, as to maintain communication with your Physical Therapist. Music will be a part of Group 2 participant’s routine for a total of three therapy visits. Assessment data on each participant in both groups will be collected by me on the initial visit prior to the inclusion of music. Ending data will be recorded by me on the fourth visit, after three routines with music have been completed. The data will then be analyzed to see if music makes any significant difference in the progress of physical therapy with sports injuries.
If you decide to participate, the proper consent forms, mandated by the state, must be signed. Taken from the Human Subjects Committee Website of Florida State University,

The Nuremberg Code states in pertinent part:

"The voluntary consent of the human subject is absolutely essential. This means that the person involved should have legal capacity to give consent; should be so situated as to be able to exercise free power of choice without the intervention of any element of force, fraud, deceit, duress, over-reaching, or other ulterior form of constraint or coercion; and should have sufficient knowledge and comprehension of the elements of the subject matter involved as to enable him to make an understanding and enlightened decision. This latter element requires that before acceptance of an affirmative decision by the experimental subject there should be made known to him the nature, duration and purpose of the experiment; the method and means by which it is to be conducted; all inconveniences and hazards reasonably to be expected; and the effects upon his health or person which may possibly come from his participation in the experiment."

I ask that you please read the following consent forms and contact me at any time with further questions regarding this project. Please consider participating as this is a break through study in the field of Music Therapy and Sports Medicine. It will be a fun, exciting study involving minimal risk to you as the patient. Thanks for your time.

Cordially,
Sarah Piercy, MT-BC

piercysarah@hotmail.com
(830) 322-0618
Parental Permission Form

My name is Sarah Piercey, MT-BC and I am a graduate Music Therapy Student from the Music Department at Florida State University. Your child is invited to be in a research study about the effects of music on the progress of physical rehabilitation in sports medicine. We are asking that your child take part because your child is in the age group we want to study. We ask that you read this form and ask any questions you may have before agreeing to allow your child to take part in this study.

The study: The purpose of this study is to find out if using music while completing regular physical therapy visits, specifically for sports related injury, speeds your child’s progress in physical therapy. If you agree to allow your child to take part, your child will be randomly assigned to one of two groups. Group I will be the control group where no music intervention occurs and only heart rate, pain perception and duration and diameter of specific exercises will be measured and recorded by the music therapist. Heart rate will be measured by a small heart rate monitor strapped to patient’s arm. Pain perception will be measured using a scale of 1-10. 1 being no perceived pain, 10 being pain that would cause patient to ask for medication. Duration of exercise will be measured in minutes, and diameter of exercises that pertain to gross and fine motor movements will be measured in inches. Group II will be the experimental group. In this group, your child’s heart rate, pain perception and duration and diameter of exercise will be measured in the same way as the control group; however, your child will be asked to complete their routine physical therapy visits with an I-pod strapped to one of their arms and a single ear phone in one ear. Your child will be asked to meet with the Music Therapist to pre-select their preferred music that will be structured by the Music Therapist to fit the course of their regular physical therapy routine. The music pre-selected by your child will be what your child will listen to while completing their physical therapy routine, if your child is placed in Group II.

Risks and benefits: The risks in this study are that the heart rate and I-pod strap may be uncomfortable to your child. There are no benefits to you or your child if he or she takes part in the study.

Compensation: There is no compensation for participation in this study.

Confidentiality: The records of this study will be kept confidential, to the extent permitted by law. The pain perception scale will only include pain ratings, child grouping, age and gender. Your child’s name will not be used.

Voluntary Participation: Your child’s participation in this study is completely voluntary. Your decision whether or not to allow your child to take part will not affect your current or future relationship with Florida State University or with your child’s physical therapist. You are free to withdraw your child at any time without affecting your relationship with the University or your child’s physical therapy clinic.
The researcher for this study is Sarah Piercy, MT-BC. You may reach her at (850)322-0618, or piercysarah@hotmail.com. Please feel free to ask any questions you have now, or at any point in the future. If you have any questions or concerns about your child's rights as a research subject, you may contact the FSU Institutional Review Board (IRB) at 850-644-8633 or you may access their website at http://www.fsu.research.edu. You will be given a copy of this consent form for your records. You may also contact the researcher's major professor, Dr. Jayne Standley in the Music Department of Florida State University at (850) 644-3424.

The data collected from this study will be included in my final thesis paper, submitted to The Florida State University at the close of the Spring 2008 semester. Following inclusion into this paper, the researcher will shred all data information collected from each participant. The final thesis submission will then be stored in a locked file cabinet in the basement office of Dr. Jayne Standley in the Kursheiner School of Music at The Florida State University. Again, any participant may contact Dr. Standley at (850) 644-3424 for further information regarding the storage of recorded data in this paper.

Please enter your child's name and sign below if you give consent for your child to participate in this study.

Your child's name: ________________________________

Your signature ________________________________ Date ____________________
Assent Form for Minors

My name is Sarah Piercey, MT-BC. I am a student researcher from Florida State University. I am asking if you would like to take part in a research study called "The Effects of Patient Preferred Recorded Music on the Progress of Physical Rehabilitation in Sports Medicine, as measured by, Heart Rate, Patient Perceived Pain and Duration and Diameter of Exercise", which is a study about the use of music in medicine.

If you agree to be in this study, you will be randomly placed in one of two groups. In both groups your heart rate will be measured by a small heart rate monitor that will be strapped to your arm. In both groups you will be asked to rate your pain three times, once before exercise, once during exercise and once after exercise on a scale of 1-10. 1 being no perceived pain, 4 being pain that would cause patient to ask for medication, 6 being pain that would begin to cause disorientation and 10 being unbearable pain, will be used. In both groups the duration of exercise will be monitored in minutes by a stop watch and the diameter of exercise will be monitored in inches by a ruler. Both groups will continue regular physical therapy routines; however, Group I will do so without music and Group II will do so with music. Those in Group II will meet with the Music Therapist to pre-select preferred music which will be loaded onto an I-pod. You will be asked to strap the I-pod to your arm, placing a single ear phone in one ear, in order to listen to the pre-selected music during your physical therapy routine. You will be asked to participate in the study for three of your physical therapy routines.

Wearing the heart rate strap and I-pod strap may be uncomfortable.

Please talk this over with your parents before you decide whether or not to participate. We have asked your parents to give their permission for you to take part in this study. But even if you parents said "yes" to this study, you can still decide to not take part in the study, and that will be fine.

If you do not want to be in this study, then you do not have to participate. This study is voluntary, which means that you decide whether or not to take part in the study. Being in this study is up to you, and no one will be upset in any way if you do not want to participate or even if you change your mind later and want to stop.
The data collected from this study will be included in my final thesis paper, submitted to The Florida State University at the close of the Spring 2008 semester. Following inclusion into this paper, the researcher will shred all data information collected from each participant. The final thesis submission will then be stored in a locked file cabinet in the basement office of Dr. Jayne Standley in the Kursteiner School of Music at The Florida State University. Again, any participant may contact Dr. Standley at (850) 644-3424 for further information regarding the storage of recorded data in this paper.

You can ask any questions that you have about this study. If you have a question later that you did not think of now, you can call me at 850-322-0618, or ask me next time. You may also contact my major professor, Dr. Jayne Standley in the Music Department of Florida State University at (850) 644-3424. If you have any questions regarding your rights as a participant in this study you may contact Julie Cooper in the Office of Human Subjects at The Florida State University at (850) 644-8633.

Signing your name at the bottom means that you agree to be in this study. You and your parents will be given a copy of this form after you have signed it.

Name of child

Signature of Child ___________________________ Date ___________________________
FSU Behavioral Consent Form

"The Effects of Patient Preferred Recorded Music on the Progress of Physical Rehabilitation in Sports Medicine, as Measured by, Heart Rate, Patient's Perceived Pain and Duration and Diameter of Exercise "

You are invited to be in a research study of the effects of preferred recorded music on the progress of physical therapy. You were selected as a possible participant because of your sports related injury and age range. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by Sarah Piercy, MT-BC, graduate Music Therapy student at The Florida State University.

Background Information:

The purpose of this study is to measure the effects of music in physical therapy, specifically related to sports medicine. Previous research in the effects of Music Therapy in Physical Therapy, have shown significant increases in the recovery rates of patients; however, the use of Music Therapy in the physical rehabilitation of sports related injuries has not yet been researched.

Procedures:

If you agree to be in this study, we would ask you to do the following things:
You will be randomly assigned to one of two groups, maintaining your regular course of physical therapy treatment. In both groups your heart rate will be measured by a small heart rate monitor that will be strapped to your arm. In both groups you will be asked to rate your pain three times, once before exercise, once during exercise and once after exercise on a scale of 1-10. 1 being no perceived pain, 4 being pain that would cause patient to ask for medication, 6 being pain that would begin to cause disorientation and 10 being unbearable pain, will be used. In both groups the duration of exercise will be monitored in minutes by a stop watch and the diameter of exercise will be monitored in inches by a ruler. Both groups will continue regular physical therapy routines; however, Group I will do so without music and Group II will do so with music. Those in Group II will meet with the Music Therapist to pre-select individualized preferred music which will be loaded onto an i-pod. The Music Therapist will structure your pre-selected music to fit the course of your regular physical therapy routine. You will be asked to strap the i-pod to your arm, placing a single ear phone in one ear, in order to listen to the pre-selected music during your physical therapy routine. You will be asked to participate in the study for three of your physical therapy routines.
Risks and Benefits of being in the Study:

There are minimal risks in this study and participants will not receive any benefits as a result of participation. The I-pod and heart rate monitor straps may be uncomfortable to wear during therapy routine.

Compensation:

You will receive no compensation for your participation in this study.

Confidentiality:

The records of this study will be kept private and confidential to the extent permitted by law. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely an only researchers will have access to the records.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University or with Tallahassee Orthopedic Sports and Physical Therapy Clinic. If you decide to participate, you are free to not answer any question or withdraw at anytime without affecting those relationships.

Contacts and Questions:

The researcher conducting this study is Sarah Piercy, MT-BC. You may ask any questions you have now. If you have a question later, you are encouraged to contact her at (850) 322-0618 or piercysarah@hotmail.com. If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, you are encouraged to contact the FSU IRB at 2010 Levy Street, Research Building B, Suite 275, Tallahassee, FL 32306-2742, or (850) 644-8633, or by email at jmscooper@fsu.edu. You may also contact the researcher’s major professor, Dr. Jayne Standley in the Music Department of Florida State University at (850) 644-3424.

The data collected from this study will be included in my final thesis paper, submitted to The Florida State University at the close of the Spring 2008 semester. Following inclusion into this paper, the researcher will shred all data information collected form each participant. The final thesis submission will then be stored in a locked file cabinet in the basement office of Dr. Jayne Standley in the Kursteiner School of Music at The Florida State University. Again, any participant may contact Dr. Standley at (850) 644-3424 for further information regarding the storage of recorded data in this paper.
You will be given a copy of this information to keep for your records.

**Statement of Consent:**

I have read the above information. I have asked questions and have received answers. I consent to participate in the study.

Signature ____________________________ Date ____________

Signature of Investigator ________________ Date ____________
# APPENDIX C

## LIKERT PAIN RATING SCALE

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
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<th>3</th>
<th>4</th>
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<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO PAIN</td>
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<td>UNCOMFORTABLE PAIN</td>
<td>INTOLERABLE PAIN</td>
<td>EXCRUCIATING PAIN</td>
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</tr>
</tbody>
</table>
REFERENCES


BIOGRAPHICAL SKETCH

Sarah Elizabeth Piercy was born on April 19, 1983 in Waterford, Virginia. Following grade school, she completed her undergraduate Music Therapy degree at Duquesne University in Pittsburgh, Pennsylvania. In fulfillment of her Music Therapy training, she then attended and successfully completed a Music Therapy internship at Big Bend Hospice in Tallahassee, Florida. In April 2005, Sarah was accepted into the Graduate Music Therapy program at The Florida State University. She passed her Board Exam to become a Board Certified Music Therapist, and hopes to continue working in Hospice upon completion of her graduate degree in the Spring of 2008.