Ritvik Yaparpalvi 2019-2020
Research Plan Biomedical & Health Sciences

Evaluating Therapeutic Instrumental Music Performance (TIMP) as a form of Upper Limb Mobility Rehabilitation for Various Disorders and Neurological Diseases

Rationale

Gross motor impairments are common after strokes, neurological diseases, and severe injuries (National Stroke Association, 2017). Stroke is the sudden death of brain cells due to the lack of oxygen, caused by blockage of blood flow or rupture of an artery to the brain. Loss of speech, weakness, or paralysis of one side of the body can be early symptoms of an apparent stroke. More than 750,000 people suffer from a stroke each year in the United States and greater than 75% of this population are age 65 years or older (National Stroke Association, 2017). Prominent forms of stroke include Ischemia, the inadequate blood supply to an organ or part of the body, especially the heart muscles, and Hemiplegia, paralysis of one side of the body. 80% of stroke victims experience Hemiplegia. When a stroke is present, there is a loss of control over movement/muscle. This prevents the correct use of everyday objects and movements (American Stroke Association, 2017).

As this can hinder everyday activities, patients that suffer from a stroke become reliant on another relative or caretaker to complete daily tasks. Limb immobility can also be caused by other forms of neurological diseases. Parkinson's Disease, Multiple Sclerosis, post-stroke Dementia, Spinal Cord injuries, Hypoxic brain damage, Cerebral Palsy, and Spina Bifida can also be critical diseases that contribute to upper limb disability (Tolea et al., 2017) (Thaut et al., 2014). This forces patients to seek help in everyday activities and have a need for a form of rehabilitation. Patients recovering from neurological diseases often require and benefit from rehabilitation therapies including Rehabilitation Nursing, Physical Therapy, Occupational Therapy, and Recreational Therapy (American Stroke Association, 2017). Many therapy types lack an incentive or fail to provide motivation, thus proven to be less successful psychologically on patients (Raghavan et al., 2016).

Music Therapy fills this void by offering an engaging alternative for neurological rehabilitation (Street et. al., 2018). Therapeutic Instrumental Music Performance (TIMP) uses musical instruments in order to stimulate functional movement patterns. In this form of Music Therapy, instruments are not typically played in the traditional manner as one may see in a performance or by a musician. They are played in a rhythmic and percussive mannered style. This is achieved to emphasize range of motion, endurance, strength, functional hand movements, finger dexterity, and limb coordination of the patient and their affected limb (Street, 2018). Despite recent studies demonstrating the effectiveness of music therapy, it is not a reimbursable treatment for neurological rehabilitation, this study seeks to explore the use of TIMP to evaluate the functional and practical benefits of coupling TIMP and Stroke and Neurological Rehabilitation (Raghavan et. al., 2016).

Research Question

What is the effect of Therapeutic Instrumental Music Performance on upper limb mobility and range of motion?

Hypothesis

Therapeutic Instrumental Music Performance (TIMP) will improve overall upper limb movement, sensory motion, and well-being in patients recovering from impairment of upper limb mobility.

Procedure

Patient Selection and Study Overview: Patients will be selected by mentor and head of adult day program at location, through a criteria:

Inclusion Criteria: Patients have to be part of the Adult Day Program at Wartburg Nursing Care, have to have a form of either Upper Limb disability, Limited limb mobility, or Limited range of motion. Patients will voluntarily participate in this study.

Time: 18 total sessions, 3 sessions per week. Sessions: 25-30 minutes.

Sample Size: 4-6 patients

Location: Wartburg Nursing Care Music Therapy Studio

Pre-assessment: Nine Hole Peg Test, Range of Motion Test, Ruler Based Measuring and GarageBand Velocity Measure test were performed. This study will be supervised by Dr. Concetta Tomaino and sessions will be led by a certified music therapist and/or supervised Music Therapy intern that have gone under the necessary training to carry out a Therapeutic Instrumental Music Performance session.

Therapy Intervention

Warmup/Beginning:

The therapy interventions will be carried out by a Certified Music Therapist and/or Music Therapy intern. At the beginning of the intervention, the therapist will warm up the movement of the patient by involving the patient in simple music exercises. These exercises include simple drumming, repeated note beating, clapping, or listening to music. Then the therapist will introduce the music and exercises the therapist and patient will be playing during the certain intervention.

Percussion Exercises:

The patients are introduced to each exercise by the therapist. Listed below are certain exercises that will be used in the intervention, based on physical ability of the patient. Some exercises are listed for 2 patients, but can be substituted by having the therapist play the role of the 2nd patient. Also, some exercises require an instrument that may need to be adjusted or substituted for based on the physical ability of the patient. These exercises will be played for 1-2 minutes each for 10 minutes in total. The order of exercises do not matter as all of the exercises are around the same level of difficulty. The therapist will either accompany the patient with background music or will put on an accompanying music. Then, the therapist watches over as the patient goes through the exercise for the allotted time.

Keyboard Exercises

Next, the therapist will guide the patient to switch from percussive instruments to the keyboard. Here, patients will be participating in fine motor exercises. These exercises will be utilizing an electronic piano. Patients will play a variety of beginner exercises, fundamentals, and patterns with the help of the therapist. As the study progresses, the patients will build the basics of piano playing and music reading to be able to do more intricate compositions. As compositions increase in difficulty, fine motor skills and finger/wrist muscles will be exercised more. The utilized keyboard will be connected to a laptop, using the program *Garageband*, in order to track finger velocity of patients— another area of assessment. These exercises will also be done for 10 minutes.

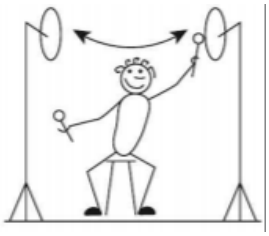
Cool Down/End of Intervention:
Following the fine motor set of exercises, the patient and therapist will do cool down, where they rest the exercised muscles and recap what went on during the session. At this point of the intervention, the therapist or other interns will ask the patient to answer the questions from the survey. Following the conclusion of the survey, the therapist and patient will reach the end of the session. This session procedure will be followed through each intervention a patient will go through during this study.

Role of Student vs. Mentor

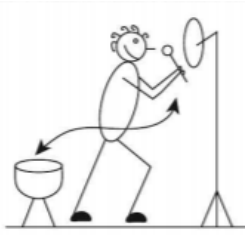
Role of Student	**Role of Mentor**
Main Role: Observing the intervention, assisting the patients and therapist, and assessing patients with testing - Helping therapist in guiding patient prior, during, after interventions - Taking notes and observations of patient trends during intervention - Taking data and completing assessments with patients - Setting up studio with equipment, assessments, music/audio system, and instruments.	- Creating a list of possible patients that will be invited - Helping to finalize the intervention layout - Helping to choose correct and proper assessments for this study - Providing the specific and necessary equipment and instruments - Supervising the safety of each patient during each session

Gross Motor Exercise Diagrams (Thaut et al., 2014) :

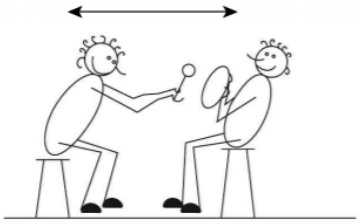
1) Sit between the cymbals and shift your weight from one side to the other, lift up buttock and stretch up to hit the drum on each side



2) Stand in a stride position, hold the mallet in both hands, and hit the cymbal in front of you and then the timpani diagonally behind you

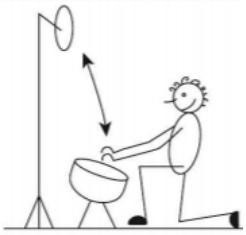


3)
- Leaning forward and back while sitting
- Reaching through elbow flexion and extension

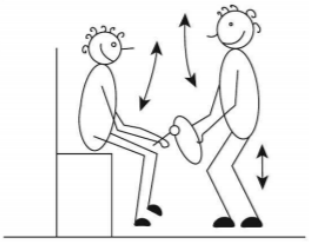


- Leaning forward and back while sitting
- Reaching through elbow flexion and extension

4) Kneel down on one knee on the soft mat, then hit the drum in front of you with both hands and reach up to play the bongos in front of you



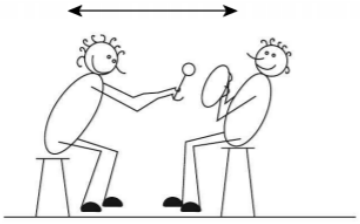
5)
- Shoulder extension
- Elbow flexion and extension



- Mini quads (upper leg strengthening)
- Shoulder extension
- Elbow flexion and extension

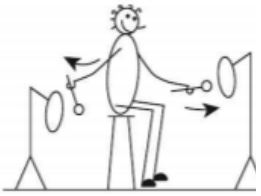
6) Stand between the instruments, hold the mallet with both hands, hit the drum behind the body, and then hit the cymbal in front of you

7)
- Leaning forward and back while sitting
- Reaching through elbow flexion and extension

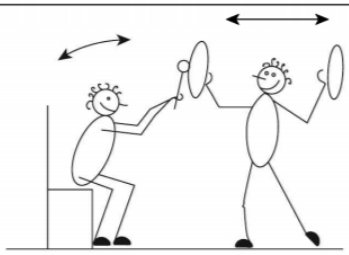


- Leaning forward and back while sitting
- Reaching through elbow flexion and extension

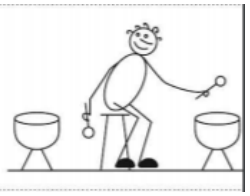
8) Hold a mallet in each hand and hit the instruments alternately in front of and behind you



9)

Patient 1	Exercise	Patient 2
• Weight shift in a sitting position • Stretching trunk • Shoulder extension • Elbow extension		• Weight shift in a standing position • Trunk erection • Shoulder extension • Elbow extension

10) Sit between the two instruments, and shift your weight from side to side and stretch out your arm to hit the instruments on each side



Testing and Assessment:

This study will consist of 6 methods of testing and assessing change.

Nine Hole Peg Test: Measures finger dexterity, also known as fine manual dexterity, through the testing of the patient's ability to pick up the nine pegs one at a time as quickly as possible, puts them in the nine holes, and, once they are in the holes, removes them again as quickly as possible one at a time, replacing them into the shallow container. It can be used with a wide range of populations, including clients following a stroke, experiencing a neurological disorder, or undergo injury. Additionally, the 9 hole peg test is a relatively inexpensive test and can be administered quickly.

Range of Motion Evaluation: A set of exercises that are measured to see improvement in various joint movements throughout the body. From this set of tests, the upper limb, hand, and upper body movements will be utilized to see improvement in patients.

Ruler Based Measuring: A photo or live recording of range of motion, vertically or horizontally, using a meter stick.

Garageband Velocity Measure: Garageband is a program that is controlled digitally. This program can connect to an electric piano and can measure finger velocity of the patient while they are playing.

These tests will be given before the start of the study, again after 2 weeks, 4 weeks and at the end of the study

Wong Baker Scale: A pain scale that shows a series of faces ranging from a happy face at 0, or "no hurt", to a crying face at 10, which represents "hurts like the worst pain imaginable". Based on the faces and written descriptions, the patient chooses the face that best describes their level of pain. This will be implemented in the patient survey.

Patient Survey: A survey administered electronically that patients answer with simple responses. Survey asks questions regarding enjoyment, pain, enthusiasm, comfort, and comments on therapy sessions.

These tests/surveys will be given to patients at the end of each session

Risk and Safety

The potential risks or discomforts can come from the slight pain during the musical exercises of the limb. This could affect the recovery from the stroke or neurological disease of the patient. We will minimize risk by continuously asking what is their comfort level and what they feel is helping them but is not causing abnormal therapy pain. The benefits of having a slight discomfort would help the patient regain the movement of the upper limb or affected area.

Data Analysis

Data from the assessments during the study for each individual were viewed and compared to quasi-baseline data from before the study to find changes in patients' abilities in upper limb arm movement. This included comparing the data of the Nine Hole Peg Test, Range of Motion Evaluation, the *Garageband* velocity measurements, as well as the Wong-Baker Scale scores.

Human Participants Research

Participants

The age range of this study will be people above the age of 60, both genders, widespread racial composition. The elderly aged participants in this study are vulnerable to injury if pushed to past their exercise limit. The participants will be capable of giving consent to this study.

Recruitments

The recruitment will be done at Wartburg Nursing Care/Home. Patients will be researched and invited by mentor of this study. Patients will be voluntarily chosen from the Adult Day Program at the institution. They will be formally asked if they would like to join a novel form of neurological therapy that would consist of three times per week, which would consist of music and exercise.

Methods

Participants will be asked to follow the schedule of attending 3 therapy sessions per week. During the sessions, patients will be asked to actively participate in the specified TIMP exercises. Patients will participate in these TIMP exercises with the guide of the music therapist. They will be taking 6 different tests throughout the study and will be asked a simple set of questions (attached) as part of a survey to understand the basic emotions of patients during the intervention. Each subject will have 3 therapy sessions per week, each being 30 minutes long, over 6 weeks.

Risk Assessment

The potential risks or discomforts can come from the slight pain during the musical exercises of the limb. This could affect the recovery from the stroke or neurological disease of the patient. We will minimize risk by continuously asking what is their comfort level and what they feel is helping them but is not causing abnormal therapy pain. The benefits of having a slight discomfort would help the patient regain the movement of the upper limb or affected area.

Protection of Privacy

Identifiable information will be collected. Most parts of the information will be anonymous. They will be collected through surveys and Q&A's, but will not be made public in reports. Information such as age and severity of their stroke will be collected similarly, and will be made public in reports. Data will have already been stored in the database of the nursing home. Only members who read the report will have the public information, while the confidential data will be kept to those who have access to the secure database. The public data will be used to show improvement based on age, gender and severity; other anonymous data will be used for differentiation between patients.

Informed Consent Process

Informed Consent Form will be filled out by the participants in this study. The form is attached to this document.

References

M. Zelazny, Colleen. (2001). Therapeutic Instrumental Music Playing in Hand Rehabilitation for Older Adults with Osteoarthritis: Four Case Studies. Journal of music therapy. 38. 97-113. 10.1093/jmt/38.2.97.

Raghavan, P., Geller, D., Guerrero, N., Aluru, V., Eimicke, J. P., Teresi, J. A., ... Turry, A. (2016). Music Upper Limb Therapy—Integrated: An Enriched Collaborative Approach for Stroke Rehabilitation. Frontiers in Human Neuroscience, 10, 498. http://doi.org/10.3389/fnhum.2016.00498

Street, A. J., Magee, W. L., Bateman, A., Parker, M., Odell-Miller, H., & Fachner, J. (2018). Home-based neurologic music therapy for arm hemiparesis following stroke: results from a pilot, feasibility randomized controlled trial. Clinical Rehabilitation, 32(1), 18–28. http://doi.org/10.1177/0269215517717060

Street, Alexander J. et al. "Home-Based Neurologic Music Therapy for Upper Limb Rehabilitation with Stroke Patients at Community Rehabilitation Stage—a Feasibility Study Protocol." Frontiers in Human Neuroscience 9 (2015): 480. PMC. Web. 27 Apr. 2018.

Thaut, M. H. et al. (2014). Neurologic Music Therapy in Stroke Rehabilitation. Stroke Rehabilitation.

Thaut, M. H., & Hoemberg, V. (Eds.). (2014). Handbook of neurologic music therapy. New York, NY, US: Oxford University Press.

Thaut, M. H., & Hoemberg, V. (Eds.). (2014). Handbook of neurologic music therapy. New York, NY, US: Oxford University Press.

Yoo, J. (2009). The Role of Therapeutic Instrumental Music Performance in Hemiparetic Arm Rehabilitation. Music Therapy Perspectives. 27. 16-24. 10.1093/mtp/27.1.16.

Therapeutic Instrumental Music Performance Intervention Survey

1. Did you enjoy today's session?

- Yes
- No

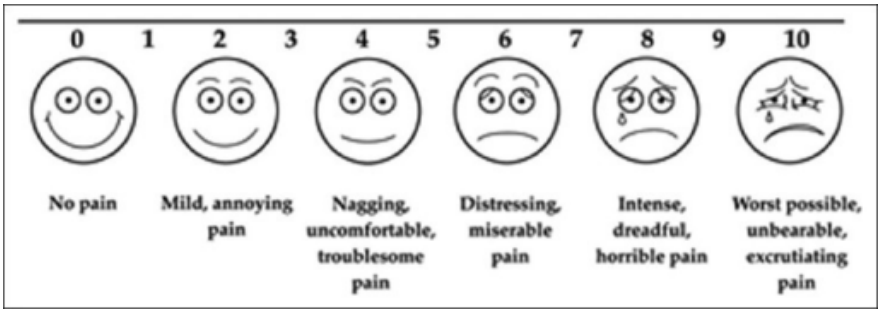
2. Did you find the music we played motivating?

- Yes
- No

3. Would you like to play similar music in our next session?

- Yes
- No

How much pain did you feel today?



4. Please choose one of the selections above

- [ ] 0- No pain
- [ ] 1
- [ ] 2- Mild, annoying pain
- [ ] 3
- [ ] 4- Nagging, uncomfortable, troublesome pain
- [ ] 5
- [ ] 6- Distressing, miserable pain
- [ ] 7
- [ ] 8- Intense, dreadful, horrible pain
- [ ] 9
- [ ] 10- Worst possible, unbearable, excruciating pain

5. Did you feel motivated to participate more because of the music?

- Yes
- No

6. Would you say you learned something that interested you?

- ◯ Yes
- ◯ No

7. Any other comments or questions?