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A Music Therapy Protocol for Pain Management in Individuals with Cerebral Palsy

Zoe Reddick
zoe.reddick@bobcats.gcsu.edu

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Clinical Project

Master of Music Therapy

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Chapter One

Introduction and Background Information

According to the Centers of Disease Control [CDC] (2020), approximately one in 345 people in the United States have been identified with cerebral palsy. Hirsh et al. (2012) discovered 63% of the population with cerebral palsy reported living in chronic pain. The most common pain areas included the lower back, hips, and legs (Hirsh et al., 2012). Pain can increase to extreme heights after required surgeries, injections, and additional therapies. However, music has been shown to have a positive effect on pain perception (Kant & Akpinar, 2017; Tan et al. 2010). Music cannot only reduce pain while played during intramuscular injections in a population of healthy adults (Kant & Akpinar, 2017), but it can also decrease pain and muscle tension levels in burn victims while their dressings are changed (Tan et al., 2010). Unfortunately, while there is documented research for the use of music therapy as an analgesic tool for other populations, there are currently no assessment tools or treatment protocols designed to treat pain symptoms in individuals with cerebral palsy. In this chapter I will provide foundational knowledge about cerebral palsy, music therapy with the cerebral palsy population, and music therapy and pain. I will describe the problem of why we should be aware of the potential causes of pain, have appropriate assessment tools, know how to use them, and have different ways to treat the diverse types of pain experienced. Finally, I will outline the specific purpose as well as goals and outcomes of the Management for Differing Types of Pain in Cerebral Palsy: Music Therapy Protocol created by the music therapist from the existing literature and clinical practice.

Cerebral Palsy

Cerebral palsy is a disorder caused by abnormal brain development that can affect the muscle tone, movement, or posture of the inflicted (Rosenbaum, 2007). There are four specific types of cerebral palsy: spastic, ataxic, dyskinetic, and mixed cerebral palsy (Rosenbaum, 2007). Individuals with spastic cerebral palsy experience increased muscle tone, which causes tightness of their muscles. Eighty percent of individuals with cerebral palsy have spastic cerebral palsy. Dyskinetic cerebral palsy causes individuals to have difficulty moving their muscles, especially their extremities. Three common movement disorders include dystonia, athetosis, and chorea. Dystonia causes repetitive and twisting movements while athetosis causes slower writhing movements, and chorea causes irregular and sudden movements. Having a coordinated gait and proper depth perception can be a struggle for this population. Ataxic cerebral palsy presents issues with balance and coordination, often causing individuals to have tremors. Lastly, mixed cerebral palsy occurs when an individual experiences multiple symptoms from different types of cerebral palsy. Usually, individuals diagnosed with mixed cerebral palsy have a mix of spastic-dyskinetic cerebral palsy. However, any of the types listed can be seen in an individual diagnosed with mixed cerebral palsy.

It is estimated that the causes are congenital in 85% to 90% of individuals with cerebral palsy (CDC, 2020). Contributing factors to congenital cerebral palsy include a variety of pre-natal and peri-natal causes including small birth weight, premature birth, carrying multiple babies during pregnancy, infections during pregnancy, infertility treatments, and birth complications. (CDC, 2020). Those that obtain cerebral palsy post-natal refer to the condition as acquired cerebral palsy. Any infections that cause damage to the brain or keep the brain from developing after birth, such as meningitis or head traumas can cause cerebral palsy. Individuals with cerebral palsy have social, communicative, emotional, and motor needs and are enrolled in

several different therapies to treat those needs (National Institute of Neurologic Disorders and Stroke [NIH], 2023). However, another issue many individuals suffer from is chronic and acute pain (Van Der Slot et al., 2012).

Seventy-five percent of adults diagnosed with cerebral palsy reported having experienced chronic pain lasting for more than three months (Van Der Slot et al., 2012). Chronic pain can involve headaches, muscle and skeletal pains, gastrointestinal pain and reflux, and activities of daily living. Individuals with cerebral palsy also experience postoperative and procedural pain, such as pain inflicted by botulinum injections and surgeries (CDC, 2020). Common pain treatments include medication, surgeries, and non-pharmacological approaches such as warm or cold baths, massages, exercise, and stretching (CDC, 2020). However, researchers have found that many of these interventions used to alleviate pain can cause even more pain, especially exercise, surgeries, and massages (Hadden et al., 2002; McKearnan et al., 2004; Schwartz et al., 1999).

Pain can often be debilitating while completing daily tasks, recovering from surgery, and after physical therapy exercises that many of this population experience daily. Researchers discovered adults with cerebral palsy reported experiencing high levels of self-reported pain that impacts their daily activities, work, and sleep (Rodby-Bousquet et al., 2021). Pain cannot only affect the physical attributes of an individual with cerebral palsy but mental attributes as well. In addition, pain and fatigue are interrelated and both specifically relate to mental health in young adults with cerebral palsy (Van Gorp et al., 2021). Along with pain, individuals with cerebral palsy have many different motor, communication, emotional, social, and pain needs. However, music therapy can use specific techniques to address these needs.

Cerebral Palsy and Music Therapy

Music therapy is the therapeutic approach of using music as a tool to assist clients in reaching nonmusical goals. One specific model of music therapy is neurologic music therapy which uses specific interventions to target sensorimotor training, speech and language training, and cognitive training (The Academy of Neurologic Music Therapy, 2022). There are several Neurologic Music Therapy techniques that have improved movement and gait for individuals with cerebral palsy. These techniques include Pattern Sensory Enhancement (PSE) and Rhythmic Auditory Stimulation (RAS) to assist this population's movement and gait. The interventions can be extremely successful in having an individual with cerebral palsy learn to walk, move, stand, and sit independently (Efraimidou et al., 2016; Kwak, 2007; Peng et al., 2011; Wang et al., 2013).

Non-neurological music therapy techniques can also assist individuals with cerebral palsy. Music therapy can help individuals with cerebral palsy reach their communication and emotional goals (Roginsky, 2020) by using a cycling jacket with boxes that when touched provide sensory vibrations and play music notes through an electronic piano, a music therapist developed the “piano jacket” (Lampe, 2019). Through the use of this piano jacket, individuals with cerebral palsy can participate in music playing and promote pride and self-esteem (Lampe, 2019). While addressing communication, emotional, and motor skills for individuals with cerebral palsy are important, pain can limit and decrease the progress made in these areas. Without managing pain first, it can negatively impact individual's activities of daily living, overall functioning, social life, and self-care (Jarl et al., 2019; Morgan & McGinley, 2014; Rodby-Bousquet et al., 2021).

Music Therapy and Pain

Two major groups of analgesics are anti-inflammatory drugs and opioids (Cleveland Clinic, 2023). Individuals with cerebral palsy are twice as likely to be prescribed opioids than the general population (Garca Jalon et al., 2021). These medications can be highly addictive and have major side effects (Cleveland Clinic, 2023). Fortunately, music and music therapy can offer noninvasive and nonaddictive pain relief. By using music as a distraction from pain, music becomes an analgesic tool without any side effects or addictive qualities (Nilsson, 2008). The gate control theory proposed by Melzack and Wall (1965) explained how the perception of pain can be decreased by "closing the gates" in the central nervous system. Distraction and release of tension are said to keep the pain signal from traveling to the brain. Through music being used as a source of distraction or to aid muscle relaxation, individuals can better manage their perception of pain (Economidou et al., 2012).

Through a systematic review by Nilsson (2008), the most common music or music therapy interventions used in pain management was receptive listening. This calls for the individual to listen to music rather than taking an active role in the music-making process. Using pre-recorded music has been shown to decrease pain in many different populations (Nilsson, 2008). Other music therapy interventions used included guided relaxation, entrainment, and receptive and recreative experiences with the use of live music (Nilsson, 2008). While these musical interventions have different procedures, the musical elements used to decrease pain were similar.

Musical elements included tempo, lyrics, instrumentation, volume, and duration all played an essential role in the therapeutic aspect of decreasing pain and were similar when comparing successful studies within the systematic review (Nilsson, 2008). Tempo of the recorded music ranged from 60 beats per minute to 80 beats per minute. This tempo reflects the

resting heartrate and aids in the relaxation of the individual. The music did not have lyrics, consisted mostly of lower tones, the instrumentation included mostly strings and had minimal brass instruments and percussion. The maximum volume did not exceed 60 dB, the individual's preferred music was used when available, headphones were used, and successful interventions had a minimum duration of 30 minutes for the intervention (Nilsson, 2008).

Problem Statement

Pain is a difficult phenomenon to understand when communicating with neurotypical people. Thirty to fifty percent of individuals with cerebral palsy have an added cognitive disability as well, making pain especially difficult to communicate to a treatment team and caregivers (Stern, 2023). Pain can be debilitating and can alter participation in daily and social life when not communicated and treated properly (McKearnan et al., 2004; Rodby-Bousquet et al., 2021). Therefore, we should be aware of the potential causes of pain, have appropriate assessment tools, know how to use them, and have different ways to treat the diverse types of pain experienced.

Several research studies have been conducted examining the effects of music or music therapy as an analgesic tool and assisting in muscle relaxation (Gutgsell et al., 2013; Kant & Akpinar, 2017; Tan et al., 2010; Yu et al., 2009). However, few researchers have examined the effects of music on pain symptoms within the cerebral palsy population. Several members of the cerebral palsy population suffer from chronic pain and music therapy can provide noninvasive and nonaddictive relief. Finding another analgesic tool to help with their pain management can provide them with relief. Further, another analgesic tool can provide caregivers of individuals with cerebral palsy relief in knowing that the individual is not suffering from pain.

Purpose Statement

The purpose of this project was to develop an individualized Management for Differing Types of Pain in Cerebral Palsy: Music Therapy Protocol on the use of music therapy for pain management and reduction with individuals with cerebral palsy. Most studies addressing pain and music therapy do not investigate the cerebral palsy population. Therefore, a synthesis of the current literature of pain and music therapy informed the development of this protocol. Many individuals in this population experience pain daily and research investigating pain management for this population is needed. For individuals with cerebral palsy, pain can be specific to their diagnosis or non-specific to their diagnosis and experienced by the general population as well (McKearnan et al., 2004). The protocol developed outlines interventions to reduce pain specific to the cerebral palsy diagnosis based on a synthesis of the literature from different populations experiencing pain.

Researchers examining pain in individuals with cerebral palsy have identified several main categories. These include muscle and joint pain, headaches from tension, pain from injections, pain from surgeries, and abdominal pain (Jahnsen et al., 2004; McKearnan et al., 2004; Penner et al., 2013; Perquin et al., 2000; Schwartz et al., 1999; Vogtle, 2009). Interventions are targeted towards these specific pain sources. The protocol has practical and theoretical implications for music therapists to use when working with an individual with cerebral palsy experiencing different types of pain.

The protocol can be implemented in future studies, to test its effectiveness, reliability, and validity. This protocol allows future music therapists to assess the pain of their clients and then make clinical decisions based on the assessment. Depending on the source and cause of the pain determined by the assessment, the protocol will indicate the type of intervention to use. Since music therapy can be used to alleviate pain in similar populations, the predicted outcome is

similar for individuals with cerebral palsy. With successful completion of the protocol, music therapists will have a research-based protocol to follow when treating individuals with cerebral palsy experiencing diverse types of pain.

Chapter Two: Literature Review

Pain and Cerebral Palsy

This project was to develop an individualized music therapy treatment protocol for pain management/reduction with individuals with cerebral palsy based on the literature. In this chapter, I present relevant research regarding the use of music and music therapy for pain, specific music therapy interventions for pain, and music therapy for individuals with cerebral palsy.

When speaking to neurotypical individuals, pain can be a tough concept to understand. Many people with cerebral palsy have cognitive disabilities too, so pain can be especially difficult to communicate to a treatment team and caregivers. Pain can be debilitating and can alter participation in daily and social life when not communicated and treated properly (McKearnan et al., 2004; Rodby-Bousquet et al., 2021). Therefore, we should be aware of the potential causes of pain, have appropriate assessment tools, know how to use them, and have diverse ways to treat the different types of pain experienced.

Individuals with cerebral palsy can experience pain from the direct effects of damage to their motor neurons or pain related to their muscle spasticity, deformity of joints, and other musculoskeletal causes. These individuals can also experience pain due to mechanical, chemical, or thermal damage that can be experienced by the general population as well (McKearnan et al., 2004). When examining pain directly related to the direct effects of the cerebral palsy diagnosis, researchers have found similar pain types and locations between individuals with cerebral palsy. These types or areas include muscle and joint pain, headaches from tension, pain from injections and surgeries, and abdominal pain (Jahnsen et al., 2004; McKearnan et al., 2004; Penner et al., 2013; Perquin et al., 2000; Schwartz et al., 1999; Vogtle, 2009).

Many individuals with cerebral palsy experience chronic and acute pain from surgeries, injections, tension, and other sources specific to their diagnosis (McKearnan et al., 2004). However, little research exists where researchers examine the use of music or music therapy with these painful interventions. Therefore, we must look at studies within different populations where music and music therapy have been beneficial in alleviating pain. It appears music can be helpful in the treatment of chronic and acute pain alleviation for those with chronic diseases (Gutgsell et al., 2013; Hsieh et al., 2018); those seeking care in hospital settings (Mandel et al., 2019; Sand-Jecklin & Emerson, 2010); those experiencing and recovering from surgery (Guerrier et al., 2021; Jose et al., 2012; Schnieder, 2018; Tan et al., 2010; Wang & Tian, 2021); and those experiencing injections (Kant & Akpinar, 2017). With the understanding that music and music therapy can assist in pain management, researchers have begun to evaluate what techniques can alleviate different types of pain.

Music, Music Therapy, and Chronic Pain

Chronic pain is defined as pain lasting for over six months and still persists after the causing condition has been treated (Cleveland Clinic, 2023). Several researchers examined using music therapy as an analgesic tool for chronic pain and provided significant results in different populations (Gutgsell et al., 2013; Kant & Akpinar, 2017; Tan et al., 2010; Yu et al., 2009). Gutgsell (2013), a certified music therapist, conducted an experimental research study exploring the effects of a single session of music therapy on individuals in palliative care. Palliative care is a broad term used for those suffering from serious illnesses, and many individuals with cerebral palsy have received palliative care as an option for treatment. Music therapy interventions focused on breathing and muscle relaxation techniques along with guided imagery and music to decrease pain for those in palliative care (Gutgsell et al., 2013). The results showed a

significantly greater change ($p < 0.0001$) in the music therapy groups' pre-test and post-test scores on the numeric rating scale. The functional pain scale showed a significant decrease in pain score in the music therapy group ($p < 0.0001$) compared to the control group that was told to relax with no further instruction or music. The results from Gutgsell et al. suggest the positive effect music therapy can have on decreasing pain for those in palliative care.

Hsieh et al. (2018) examined the effects of a music intervention program completed in the home for individuals with breast cancer. Interventions were completed after the participant received surgery or chemotherapy. Each participant was given an MP3 player with 50 pieces of music on it. Musical genres included classical, parlour, popular, Taiwanese, and religious music. A wide variety of music was used so each participant could choose their preferred musical selections. Researchers examined many different variables however, one of the secondary outcomes measured was pain intensity. Effects from 60 participants were examined at six, 12, and 24 weeks throughout the study. After the six, 12-, and 24-week examinations the group receiving the home-based music intervention reported experiencing significantly reduced levels of pain ($p < 0.05$).

Music, Music Therapy, and Acute Pain

Acute pain is defined as pain that occurs quickly and then disappears without an apparent cause (Cleveland Clinic, 2023). Martin-Saavedra and Ruiz-Sternberg (2020) examined the effects of listening to music to provide pain management for individuals with primary dysmenorrhea or menstrual cramps. Two groups were examined; one listened to a composition in C major at 60 beats per minute with no percussion or lyrics while the other group listened to silence. Pain scores measured on a visual scale were significantly lower after the intervention for the participants in the music group ($p = 0.006$). Studies like Martin-Saavedra and Ruiz-

Sternberg's support the use of non-pharmaceutical, non-invasive, non-addictive, and more cost-effective ways to reduce pain and enhance pain management.

Mandel et al. (2019) gathered data to support the use of music therapy for pain management in emergency departments. During the three yearlong study, over 1,500 patients received music therapy services including music assisted relaxation (MAR), receptive interventions, musical distraction, song writing, and singing. Through paired t-tests, results showed a statistically significant decrease in pain levels retrieved by the Likert scale for the individuals receiving the music therapy interventions ($p < .0001$). Not only were the positive effects of music therapy observed but, the individuals also recognized the benefits as well. Mandel et al. (2019) reported 100% of the individuals that received music therapy would request music therapy services if they were admitted to the emergency department again. Similarly, Sand-Jecklin and Emerson (2010), examined pain in individuals admitted to West Virginia University hospital using live patient preferred relaxing music played on the Celtic harp for approximately 20 minutes. Results showed significant reductions in pain during the first session ($p = .005$) and the second session ($p = 00.3$).

Akmese and Oran (2014) explored the effects of music used with muscle relaxation exercises on lower back pain for women in the beginning of their second trimester of pregnancy. Along with an explanation of progressive muscle relaxation, the women were given a CD with instructions on relaxation exercises with background music. The participants were instructed to listen and follow the directions of the CD twice a day for eight weeks. Researchers found a statistically significant reduction in pain levels of the experimental group that completed the relaxation with music when compared to the control group ($p < .001$). Clearly, music therapy has

been effective in treating acute pain in a variety of patients. In the next section, I will discuss how music therapy has been used in treating surgical pain.

Music, Music Therapy, and Surgical Pain

Orthopedic surgery is an extremely common surgery for children with cerebral palsy (Jansheski, 2020). Schnieder (2018) implemented a descriptive research study that examined the effects of listening to music on post-operative pain in individuals who had undergone orthopedic surgery. The researcher used a survey containing a 10-point scale to measure pain, zero being no pain and 10 being the worst pain, among other questions. For the music intervention, each participant was given a CD with pre-recorded music on it, a CD player, and headphones. Each CD played the same 10 instrumental piano pieces equaling 35 minutes of music. Instrumental music pieces that were 60 to 80 beats a minute were used and self-administered by the participants. The participants filled out a log rating their pain after every use. Each piece was about three to four minutes long. The participants were told they could listen to the music at any time for as long as they wanted to, however, they needed to fill out a survey every time they listened to the music. Results from the paired t-tests displayed a decrease in pain from the pretest average of 5.43, a posttest average of 3.97. Results showed the pain scores significantly reduced from before listening to after listening ($p < .001$) (Schneider, 2018). Only four out of the 42 participants requested for pain medication during the music therapy intervention and 100% of the participants stated on their posttest they would recommend the music therapy intervention to others.

Tan et al. (2010), examined the use of music to alleviate pain during dressing changes for burn victims using two different music therapy interventions. The first intervention, music-based imagery (MBI), included a guided imagery and music intervention that calmed the patients

before and after the dressing changes (Tan et al., 2010). For the second intervention, music alternate engagement (MAE), was provided to distract patients from the pain and included receptive listening, singing, breathing, and playing instruments (Tan et al., 2010). Results were determined from a self-reported pain scale, McGill's Pain Questionnaire, and participants completed the measurement throughout the process. The results showed pain decreased significantly before ($p < .025$), during ($p < .05$), and after ($p < .025$) the dressing changes when MBI and MAE were being provided (Tan et al., 2010).

Similarly, Wang and Tian (2021) developed a quasi-experimental descriptive research study examining music's effect in reducing post-operative pain after individuals had undergone orthopedic surgery. Each of the 38 participants were given an MP3 player with headphones and were told they could listen to music as much and for as long as they would like. However, they were asked to fill out a listening log after they finished listening. The researchers used two self-reported surveys to determine pain scores and satisfaction with the music intervention. The researchers found that pain scores significantly reduced from the pre-test to post-test ($p < 0.005$).

Guerrier et al. (2021) explored the effectiveness of music on intra- and post-operative pain of individuals during cataract surgery. Individuals were randomly assigned to the treatment group, which experienced 20 minutes of music through headphones before surgery began, and the control group that wore headphones but did not listen to any music through them. Researchers found the individuals in the treatment group reported significantly less pain levels during the procedure and before discharge ($p = 0.04$). Jose et al. (2012) developed a study to assess how effective receptive music therapy is on the pain perception of individuals that have received cardiac surgery. Participants listened to a CD developed by a music therapist containing old Hindi songs, devotional songs, instrumental music and gazals. Researchers discovered a

significant decrease in the patient's post-test pain score compared to the pre-test scores. Clients reported they felt relaxed after music therapy and believed the music therapy had helped decrease their pain. Schnieder (2018), Wang and Tian's (2021), Guerrier et al. (2021), and Jose et al. (2012) results indicated how music listening can reduce pain and lessen pain medication needed after surgery.

Music, Music Therapy, and Pain from Injections

Many individuals with cerebral palsy experience pain because of injections received as a spasticity treatment. Kant and Akpinar (2017) studied the use of music on pain during intramuscular injections of healthy adults using a control group, a music group that listened to classical Turkish music, and a pressure application group where a weight tool was applied before the injection was given. Statistical significance was found between the control group and the music group, along with the applied pressure group and the music group when measuring the differences of self-reported pain scores ($p < 0.05$). Other researchers examined the effect of music during musculoskeletal corticosteroid injections. Researchers found the individuals who listened to music during their injections experienced significantly less pain after the procedure ($p = 0.013$) and a greater decrease in pain ($p = 0.031$) than the individuals that did not listen to music during their injections (Li et al., 2020). Li et al. (2020) and Kant and Akipinar's (2017) results suggest how music can lessen pain and decrease overall pain after injections.

These results support the claim that music therapy can serve as an analgesic tool for several different populations, many including similar symptoms to those with cerebral palsy such as acute and chronic muscle and joint pain, pain from surgeries, and injections. Therefore, research needs to be conducted to examine how pain in cerebral palsy can be affected using music therapy interventions.

Music, Music Therapy, and Muscle Tension

Individuals with spastic cerebral palsy have increased muscle tone making the muscles rigid and stiff causing muscle tension. This specific type of cerebral palsy with increased muscle tension affects about 80% of the individuals with cerebral palsy (CDC, 2022). Researchers have also conducted studies examining muscle tension in individuals with several different diagnoses and how music can alleviate that tension. Sand-Jecklin and Emerson (2010), measured muscle tension and pain among hospital individuals using live relaxing music played on the Celtic harp. Researchers found significant reductions in the tension in the first session ($p < .000$) and the second session ($p < .000$) (Sand-Jecklin & Emerson, 2010).

In another study, researchers examined pain in individuals with severe burns during dressing changes and discovered significant decreases in muscle tension before ($p < .05$) and after ($p < .025$) dressing changes while music-based imagery (MBI) and music alternate engagement (MAE) were being conducted (Tan et al., 2010). Tan et al. (2010) used the self-reported, Muscle Tension Inventory Scale, as well as secured interrater reliability by having nurses observe the behavior responses of the participants and objectively score the patients muscle tension level to gather the decrease in muscle tension before and after dressing changes.

Researchers are also examining music paired with progressive muscle relaxations effects on tension in individuals without known medical conditions. Kibler and Rider (1983) developed a study examining tension reduction defined by changes in skin temperature response of non-music collegiate students using music combined with progressive muscle relaxation. Participants were divided into three different groups; group one completed the muscle relaxation only, group two listened to music only, and group three had the combination of music and completing the progressive muscle relaxation. All groups displayed statistically significant reductions in the

pretest and posttest skin temperature readings. However, the progressive muscle relaxation and music combined treatment group demonstrated a greater statistically significant decrease than the other groups (p = .0001). Results from Sand-Jecklin and Emerson (2010) and Tan et al. (2010) suggest that music therapy can decrease muscle tension. More research should be conducted to examine if these results can be replicated for other individuals that suffer from muscle tension such as those with cerebral palsy.

Music Therapy and Cerebral Palsy

While there is not much literature addressing the effect of music therapy on pain experienced by individuals with cerebral palsy, this population is not foreign to the use of music therapy to assist with motor needs. Many studies have been conducted using music therapy interventions such as Pattern Sensory Enhancement (PSE) and Rhythmic Auditory Stimulation (RAS) to assist this population's movement and gait. PSE uses elements of music such as melody, rhythm, tempo, chord structure, and dynamics to create cues that trigger specific movements; these movements can reflect exercises or daily functions (The Music Therapy Center, 2016). Peng et al. (2011) examined the short- and long-term effects on the use of Pattern Sensory Enhancement during a loaded sit to stand (LSTS) exercise in children with spastic diplegia. Effects measured were the body's center of mass (COM), the time the movement took, extensor powers of the lower extremity (LE) joints, normalized jerk index (NJI), and trunk flexion angles. Results showed significant findings in the body's COM (p = 0.01), lower NJI mean, peak extensor knee (p = 0.009), and overall extensor power (p = 0.015) in the LSTS exercise for children with cerebral palsy when PSE music was present. The experimental group also performed the LSTS exercise in less time (p = 0.003) than the control group that completed

the exercise without PSE. These significant findings in the PSE music group continued for the three remaining rounds of LSTS while there was no music present.

In a similar study, Efraimidou et al. (2016) examined the effects of a music and movement treatment program on gait, balance, and psychological variables of male athletes with cerebral palsy using Rhythmic Auditory Stimulation (RAS). RAS uses rhythm as a medium of entrainment to synchronize music to an individual's movement (Efraimidou et al., 2016). The researchers found the music intervention group increased in all variables measured. While the control group data exhibited a decrease in gait, balance, and psychological factors; the intervention group showed an advancement in gait displayed by the Timed Up and Go (TUG) test, (p = .017) and 10 Meter Walk Test (MWT) for normal gait speed (p = .004) and fast gait speed (p =.005), as well as balance displayed by the Berg Balance Scale (BBS) (p = .001) and digital footchecker (p = .001) (Efraimidou et al., 2016). These results indicate a positive outcome for individuals with cerebral palsy using music therapy to help meet their motor goals. More research should be conducted for the cerebral palsy population using music therapy to meet other goals such as pain management.

Music and Pain with Cerebral Palsy

Two studies addressed the use of music as pain management for individuals with cerebral palsy. Researchers investigated pain in children receiving botulinum injections using clown care. The clowns used in the study have previous stage experience to distract children from pain and other adverse effects from hospital treatments, with music being one of the clown's major interventions (Ben-Pazi, 2017). The researchers found that children who experienced clown-care while receiving the injections experienced less pain than those without (p = 0.036). While Ben-Pazi explored the use of music as a distraction for pain management, Scartelli (1982) examined

the use of music for relaxation to aid in pain management. Scartelli (1982), developed a descriptive study examining the effects of the use of sedative instrumental feedback during Electromyographic (EMG) Biofeedback Assisted Relaxation for adults with cerebral palsy. Since this study had a small sample of six people the results were not statistically significant. However, the researcher found a decrease in muscle tension for 65% for individuals that listened to sedative music and participated in the EMG biofeedback relaxation training; while the individuals that just participated in the EMG biofeedback trainings muscle tension decreased 32.5% (Scarltelli, 1982). While both studies have positive results in decreasing pain and muscle tension, neither of them used music therapy. Developing an evidenced based protocol for the use of music in pain reduction is key to furthering the research in this very needed area of music therapy.

Music Therapy Interventions and Pain

Music therapy research in the treatment of pain in individuals with cerebral palsy is non-existent, but much can be gleamed from the existing literature on the use of music therapy in the treatment of pain. Pre-recorded music and receptive music therapy experiences are often used when addressing pain and muscle relaxation in individuals. Due to the weakness of patients in the inpatient unit at Royal Adelaid Hospital, Lester et al. (2020) used live receptive music therapy techniques to address pain and other effects while keeping patients as comfortable as possible. Family members that attended sessions were given the opportunity to participate and play the guitar if they chose to. Thirty-minute music therapy sessions were provided to the treatment group for five consecutive days. Results displayed statistically significant results in pain perception between pretest and post-test pain levels ($p < .05$).

However, some researchers have explored using live music for pain reduction interventions. Golino et al. (2019) developed a descriptive research study that examined the effects of an active music therapy intervention on individuals in an intensive care unit (ICU). The music therapist used one of two music therapy interventions depending on the participants' needs. One intervention included relaxation and guided imagery and the other was "song choice". Statistically significant decreases were found in respiratory rate, heart rate, self-reported pain scales, and self-reported anxiety levels ($p < .001$). By using live music, music therapists can use the iso-principle to match musical characteristics with the participants current state and slowly bring the participants physical state to a more relaxed condition.

Even though receptive experiences are more commonly used, Kim and Kim (2010) conducted a study examining the effects of two groups receiving different music therapy interventions for pain. One group received a receptive intervention while the other group received a singing-centered recreative music therapy intervention. The researchers found no statistical significance between the two intervention groups (Kim & Kim, 2010). Therefore, the designed protocol uses both receptive and recreative music experiences. Bradt et al. (2016) investigated the effects of live music therapy interventions for pain management as well. Group music therapy sessions were conducted and began with deep breathing to orient the participants into the new therapeutic environment. Following the deep breathing, participants experiencing chronic pain were encouraged to hum and progressively improvise vocally. Vocal improvisations led to group discussions of challenges with chronic pain and other matters. Results showed members in the music therapy group reported greater decreases in weekly pain than those in the control group. Live music therapy improvisations allow for participants to take ownership and

expression of their personal ailments that receptive music therapy does not offer the opportunity.

Conclusion

Some researchers have investigated the effectiveness of music as an analgesic tool and how it can aid in muscle relaxation (San Jecklin & Emerson, 2010; Tan et al. 2010). Researchers highlighted how music can alleviate pain and assist in relaxation. However, most researchers addressing pain and music therapy do not investigate the cerebral palsy population (Economidou et al., 2012; Gutgsell et al., 2013; Kant et al., 2017; Schneider et al., 2018; Tan et al., 2010). Many of these individuals experience pain daily and pain management for this population is needed.

Several existing music therapy interventions have been presented in the research to be successful in treating pain for different populations that have similar pain experiences as individuals with cerebral palsy may experience. Successful music therapy interventions for muscle pain and tension include slow breathing, progressive muscle relaxation, guided imagery and music, and music assisted relaxation. The music therapist believes progressive muscle relaxation would be contraindicated for the cerebral palsy population due to the spasticity of muscles making movement difficult and often impossible. Therefore, the protocol calls for music assisted relaxation to target muscle and joint pain. The protocol calls for guided imagery and music for individuals with tension headache due to the successful research of guided imagery and music with muscle tension and headaches.

During injections and surgeries, using music as a distraction or as alternative engagement has been successful in decreasing and managing pain levels in several different populations. Therefore, the protocol calls for music alternative engagement during surgery and injections. For

abdominal pain, the most common music intervention is patient preferred music, whether it is live or recorded. This intervention followed by music assisted relaxation targeting the vagus nerve that reaches into the abdomen has proved to soothe abdominal pain (Bonaz et al., 2017). Finally, the all-encompassing intervention for multiple pain areas includes the most common music therapy intervention throughout all the studies, music assisted relaxation.

Most studies presented within the literature retrieve data using a pre-test and post-test, visual analog scale or a Likert scale. Due to the simplicity of the visual analog scale and how widely accepted the tool is within the medical field, the music therapist chose it to develop the Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA) that accompanies the protocol.

The last study to directly address muscle relaxation in individuals with cerebral palsy was conducted in 1982 (Scarltelli, 1982). Researcher's previous studies have small sample sizes and future research studies need to have larger sample sizes to be able to generalize the results (Kant et al., 2017; Schneider et al., 2018; Wang et al., 2021). The music therapist hopes that the presented protocol will benefit in the research towards music therapy and pain management for individuals with cerebral palsy. This protocol can be used for future research studies to further music therapist's knowledge of treating pain in individuals with cerebral palsy.

Chapter Three

Clinical Rationale for Assessment Tool

To properly treat and manage pain, it must be accurately assessed. However, there is a lack of research on the provision of music therapy with individuals with cerebral palsy in the treatment of pain management. Therefore, an assessment tool for this specific population with music therapy implications is non-existent. A tool was developed from the literature regarding the evaluation of pain perception and pain symptoms among individuals with cerebral palsy experiencing acute and chronic pain (Bijur et al., 2001; Boonstra et al., 2008; Ferraz et al., 1990; Gallagher et al., 2002; Nilsson, 2008). The Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA) assesses the severity of the pain, generalized and central locations of the pain, how activities of daily living (ADL) might be impacted, and specific questions for music therapy treatment.

The Visual Analogue Scale (VAS) is widely accepted in the medical community to assess pain in cognitively aware adults with differing disabilities and conditions. In Nilsson's (2008) systematic review, the VAS scale was used in 12 out of the 22 studies evaluated, making it the most used tool to measure pain (Nilsson, 2008). The VAS has shown high reliability when used for acute abdominal pain as well as moderate to good reliability for individuals with chronic musculoskeletal pain (Bijur et al., 2001; Boonstra et al., 2008; Ferrraz et al., 1990; Gallagher et al., 2002). For validity, the VAS was shown to be positively correlated with 5 verbal descriptors from "much less pain" to "much more pain" as pain scores increased numerically (Gallagher et al., 2002). The VAS is easily accessible and is available online for free to the public. There is little to no training needed to administer the VAS assessment which makes this assessment tool accessible to all music therapists.

Along with the VAS, the Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA) provides therapists with information about where pain is specifically located. The human figure diagrams provide the opportunity for individuals to indicate exactly where pain is located by notating it on a diagram. Since researchers have concluded that major pain areas and types of pain experienced by individuals with cerebral palsy include muscle and joint pain, headaches from tension, pain from injections, pain from surgeries, and abdominal pain, the ACP-SPAA reflects that. (Jahnsen et al., 2004; McKearnan et al., 2004; Penner et al., 2013; Perquin et al., 2000; Schwartz et al., 1999; Vogtle, 2009). The ACP-SPAA includes questions that address each of these major pain areas. Indicating the specific location of pain provides the therapist with more individualized information than the overarching pain area allowing them to make clinical decisions.

Following the VAS and pain locator diagrams are questions asking the client to reflect on how pain impacts their activities of daily living (ADL) and specific music questions. As discussed in the literature review, many individuals with cerebral palsy live in chronic pain throughout their lives. While pain is a physical feeling, it is also a psychological phenomenon, that can be molded and changed by different life experiences (International Association for the Study of Pain, 2017). Due to this, many individuals are likely to devalue the pain they experience (Gannotti & Noritz, 2021). Therefore, the question about ADL was included to assist clients in thinking about the tasks. Finally, the assessment ends with general questions about the client's musical preferences. The protocol calls for patient preferred music to be used in the muscle and joint and the abdominal pain session protocols therefore, these questions advise the implementing music therapist, the music therapist conducting the protocol with a client, what that client's preferred music might be.

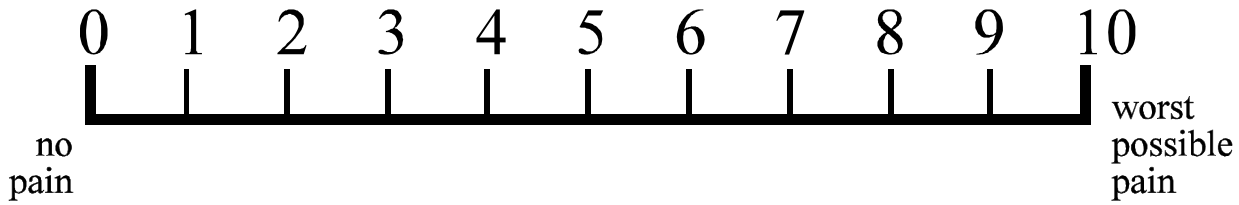
The Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA), should be completed before the completion of any pain management interventions to determine which pain areas are priority and should be addressed within the session. The ACP-SPAA should be administered at the beginning of each pain management session. Due to the nature of the setting and specific clientele this process could be different with each different client. If the client is cognitively and physically able, they can fill out the assessment themselves. However, the music therapist or a caregiver could also give varying levels of needed support to the client when filling out the ACP-SPAA. Answers to assessment questions can be provided verbally or through a communication device dictated by the client while the music therapist or caregiver physically completes the form. The caregiver can be consulted to answer questions as well to better understand pain levels of the client. To collect information for the pain locator diagrams, the music therapist or caregiver can slowly point to specific areas on the diagram, giving the client time to respond and communicate the areas of pain. The ACP-SPAA should be filled out in its entirety for proper use in music therapy interventions.

To determine which pain area is priority, the music therapist should examine all of the numerical pain scales for each area. If there is one area that has the highest numerical value, this area is the priority area, and the corresponding intervention should be completed. However, if there are multiple pain areas that have a high rating or average the same rating, the multiple areas pain intervention should be completed. The next section outlines the full Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA).

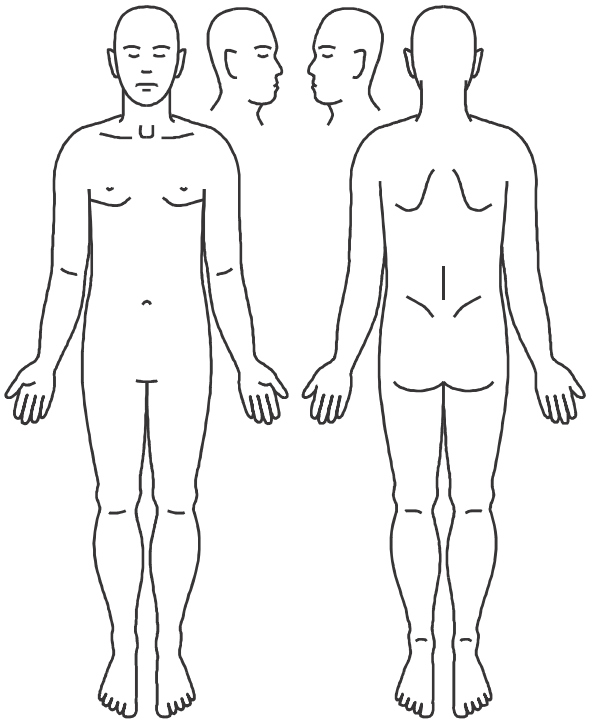
Adults with Cerebral Palsy: Specific Pain Areas Assessment
ACP-SPAA
Used for Music Therapy Services

Name: _____ Date**:** _____
Type of Cerebral Palsy: _____
Date of Birth**:** _____
Any current medications being taken for pain management: _____
_____

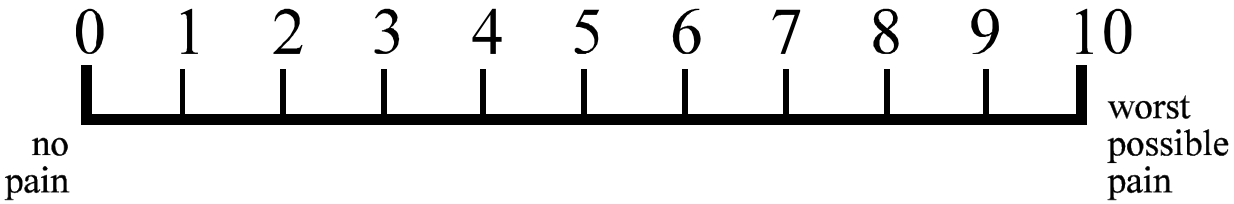
1. Please indicate the level of pain you have experienced in your muscles and joints in the past week by marking the line below:



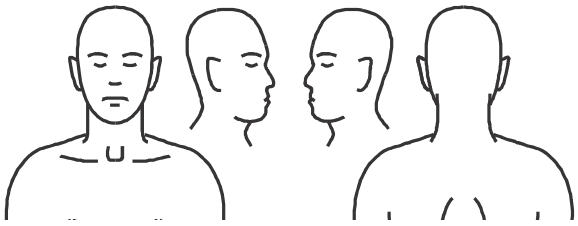
1a. Please circle the areas where you are experiencing the muscle and joint pain:



2. Please indicate the level of pain you have experienced from tension headaches in the past week:



2a. Please circle the areas where you are experiencing the tension headache pain:

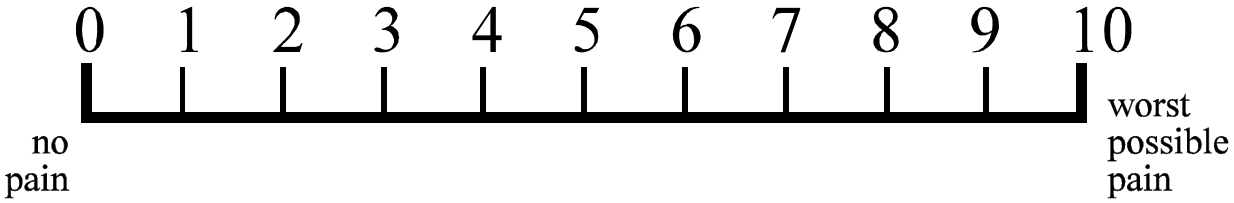


3. Have you had any injections administered or self-administered in the last week?

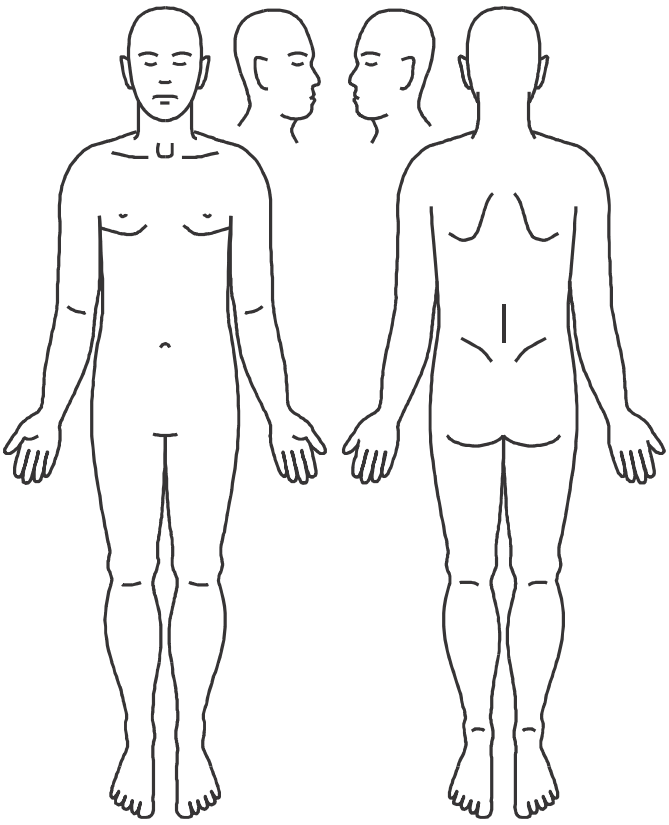
_____

3a. If yes, please answer following questions. If no, please skip to question 5.

4. Please indicate the level of pain you have experienced from any administered or self-administered injections in the past week:



4a. Please circle the areas where you are experiencing the pain from injections:



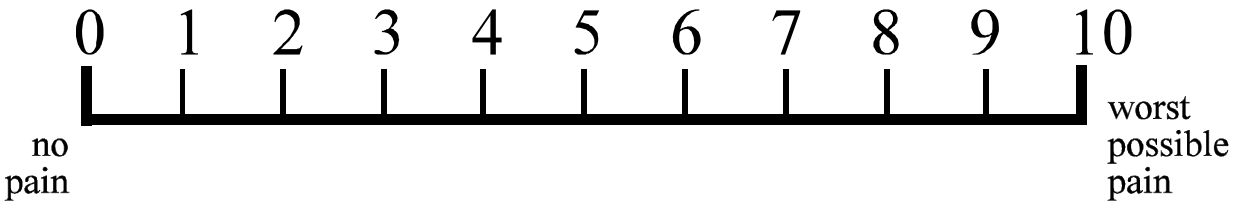
5. Have you had any surgical procedures in the last 3 months? Please list those procedures.

_____

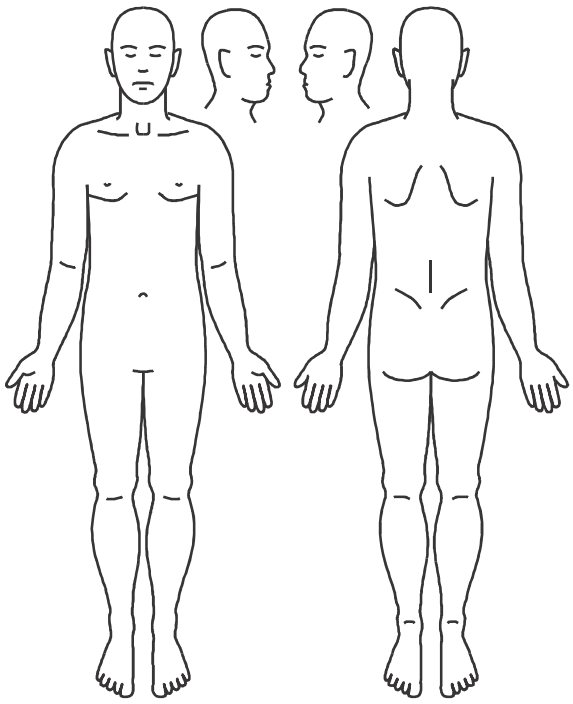
_____

5a. If yes, please answer following questions. If no, please skip to question 7.

6. Please indicate the level of pain you have experienced from any surgeries in the last 3 months:



6a. Please circle the areas where you are experiencing the pain from a surgery within the last 3 months:



Concluding Questions

7. Is the pain you are experiencing prohibiting you from completing any tasks throughout the day? Please describe how and provide explanations as best as you can.

8. What is your standard practice for pain relief?

9. What is your favorite type of music?

10. Who are some of your favorite musical artists?

11. What are some of your favorite songs?

12. What music have you been listening to recently?

13. Where do you listen to music?

14. What type of music or any songs you do not like?

15. Have you ever taken lessons on an instrument? Have you been involved in an ensemble (church choir, high school band, chorus, orchestra, etc.) Any specific instruments you do or do not like?

16. What music do you find relaxing?

The Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA) allows for the individual's pain to be properly assessed and outlines a plan of treatment for the implementing music therapist. All components of the assessment are based on existing literature and provide a synthesis of what pain the individual is experiencing so it can be better treated. The Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA) is the first step in formulating a pain relief plan for individuals with cerebral palsy experiencing pain.

Chapter Four

After assessment the next step is treatment of pain, therefore in this chapter the Management for Differing Types of Pain in Cerebral Palsy: Music Therapy Protocol based on the research will be presented. This protocol can be used by practicing music therapists when working with individuals with cerebral palsy experiencing pain. The music therapist created this protocol to contribute to the research of music therapy as an analgesic tool when working with individuals with cerebral palsy. Prior to this protocol, an individualized and flexible pain assessment and outline of interventions to treat pain in individuals with cerebral palsy based on detailed synthesized research was non-existent.

All interventions are based on prior research studies that have helped reduce, improve, or manage pain for different populations that have similar pain experiences as individuals with cerebral palsy. The music therapist has developed five different music tracks through GarageBand to assist in the implementation of the protocol. This chapter provides rationale for why specific practices were chosen for the protocol, how musical decisions were made by the music therapist, how the tracks can be used in specific interventions, and includes recommendations for the implementation of live music.

Therapeutic Rationale

Pain is a complex phenomenon to understand and is further complicated by how pain can affect people differently. Pain can come from various sources and affect different areas. Individuals with cerebral palsy cannot only experience pain that members of the general population can experience but also pain from the symptoms that accompany their diagnosis. In this chapter, the treatment protocol developed will outline evidence-based interventions to reduce pain identified as a result of the ACP-SPAA.

Management for Differing Types of Pain in Cerebral Palsy: Music Therapy Protocol

Figure 1 presents the Management for Differing Types of Pain in Cerebral Palsy: Music Therapy Protocol in a flowchart layout. The implementing music therapist should follow the steps of the protocol by reading the flowchart from top to bottom. As well as using the session protocols presented later in this chapter to structure sessions for individuals with cerebral palsy. For the implementation of this protocol, the implementing music therapist needs a pulse oximeter to observe heart and respiration rate. A helpful tool that should be used in the implementation of the protocol would be the NIOSH Sound Level Meter App to measure the decibels of sound when playing live or recorded music and ensuring that the sound does not exceed 60 dB.

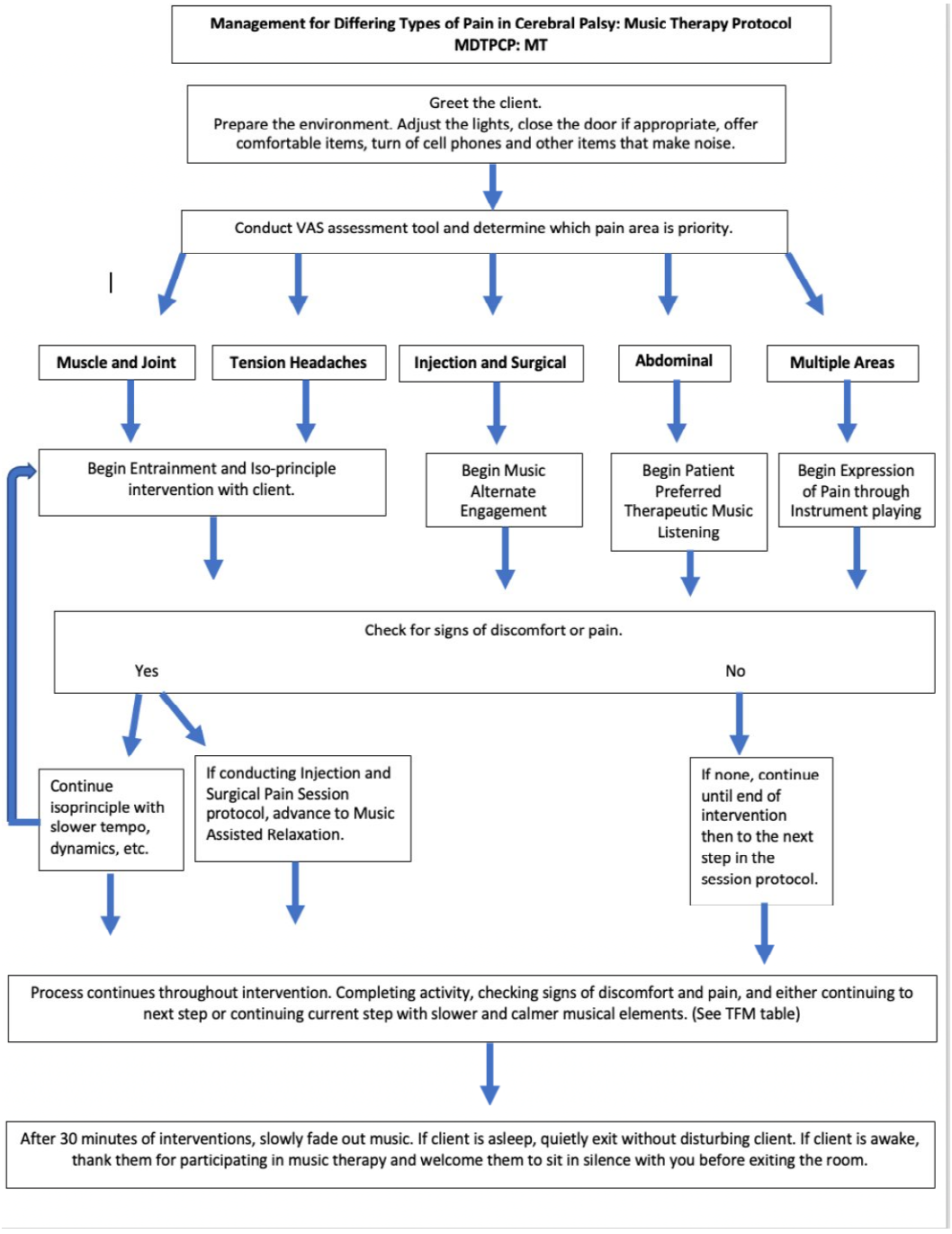
All session protocols are timed to equal 30-minute sessions. Studies that had music for more than 30 minutes did not show a significant effect on pain. The most significant effect on pain relief was discovered when music was administered once per day for 14-30 days (Martin-Saavedra, 2018). The music therapist recommends that sessions be no longer than 30 minutes long once a day. The implementing music therapist should make clinical judgements on how long interventions within the session should be when working with clients. Using the outline of the protocol, intervention length might be different with each individual client. The protocol interventions should be adapted to fit the client's specific needs.

Throughout each intervention within the session the music therapist should check for any signs of pain or discomfort. For speaking clients or those with communication devices, this can be a simple verbal check in. However, for non-speaking clients without communication devices the music therapist should be aware of behaviors that can indicate pain or discomfort. Some facial expressions could include frowning, grimacing, twitching, or looking frightened (Galerstein et al., 2005; Wong, 2023). Clients might also throw their head back in discomfort or

turn their head away from the music therapist, an instrument, or an activity. Their muscles might tense up, stiffen, or clients might begin to have muscle spasms when they are experiencing pain. The client's demeanor might change as well. They might go from being very social by making eye contact and appearing to be engaged in the session, to avoiding the music therapist and trying to distance themselves with their posture away from the music therapist or instruments. Finally, clients might make vocalizations such as grunting, moaning, or crying to indicate that they are in pain (Galerstein et al., 2005; Wong, 2023).

Figure 1

Management for Differing Types of Pain in Cerebral Palsy: Music Therapy Protocol



Note. This figure demonstrates the protocol in a flowchart format. The flowchart should be read from top to bottom and denotes the order or procedure when completing the protocol. This flowchart should be used in conjunction with the session protocols.

The first step in the protocol outlined in all sessions is to greet the client and adjust the environment. Before beginning specific music therapy practices, the music therapist should prepare the environment (Gutgsell et al., 2013; Mandel et al., 2019). This includes controlling the surroundings to minimize disruptions and to create a relaxing environment for the client. Examples include lowering the lights, closing doors or windows, offering comfortable items (pillows, blankets, etc.), and turning off cell phones or other items that make noise. Later in the intervention, the music therapist will conduct music assisted relaxation; therefore, having a relaxing environment allows for clients to make an easier transition into relaxation (Gutgsell et al., 2013; Mandel et al., 2019).

After preparing the environment for relaxation, the protocol calls for the music therapist to conduct the ACP-SPAA. Chapter three outlines how to administer the Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA) and how to determine the client's priority area. After determining what the priority area is, the music therapist will start the corresponding intervention. The main types and locations of pain experienced by individuals with cerebral palsy are reflected in the ACP-SPAA to be muscle and joint muscle and joint pain, headaches from tension, pain from injections, pain from surgeries, and abdominal pain (Jahnsen et al., 2004; McKearnan et al., 2004; Penner et al., 2013; Perquin et al., 2000; Schwartz et al., 1999; Vogtle, 2009). Therefore, the protocol includes interventions for each of these major pain areas and an all-encompassing intervention for when a client is experiencing pain in multiple different areas at the time of assessment.

Based on the literature, there are several existing evidence-based music therapy interventions to provide pain management in a range of different populations. By synthesizing

the existing research, the following protocol has been developed by using evidence-based techniques that provide relief of the pain perception for individuals experiencing pain in muscle and joints, tension headaches, pain from injections and surgeries, and abdominal pain.

Evidence Based Music Therapy Practices

Entrainment and Iso-Principle with Client

After preparing the environment for relaxation, the client should be prepped as well. This preparation of the client should be done through entrainment and the iso-principle. Entrainment and the iso-principle allow the music therapist to slowly guide the client into a relaxed state and prepare for the targeted pain intervention. This process requires the music therapist to use live or to manipulate recorded music to match the client's vital signs and if needed bring certain vital signs to an appropriate level such as a heart rate of 60 to 100 beats per minute, a respiration rate of six breaths per minute for relaxation and 10 to 20 breaths per minute for regular respiration (Russo et al., 2017; Yurkovich et al., 2018). The music therapist can entrain the clients breathing, heart rate, or other vital signs depending on what equipment is available to the music therapist. A pulse oximeter is affordable and allows for continuous monitoring of heart rate and oxygenation levels.

When comparing music used for entrainment with patient preferred music, researchers have observed somatosensory changes consistent with processing pain when participants are experiencing entrainment that were not observed with listening to their preferred music (Hunt et al., 2021). Music therapy entrainment has also lessened pain symptoms such as writhing muscles and moaning to a peaceful sleep and a relaxed effect when awoken for case studies of individuals in hospice care (Dimaio, 2010). In Yurkovich's et al study (2018), 80% of participants demonstrated a decrease in heart rate during the entrainment intervention of decreasing the

music's tempo by five beats each minute. Entrainment allows for the client to begin relaxing and prepare for specific music assisted relaxation.

The "Heartbeat Music Entrainment" track can be used for the entrainment and iso-principle intervention. First the music therapist should use a pulse oximeter to determine the client's initial heart rate. Using the GarageBand access of the track, the music therapist can then manipulate the track's tempo to match the client's heart rate. The music therapist should allow the track to play at the client's heart rate tempo for two minutes. After the first two minutes, reduce the tempo of the track by five beats per minute (Yurkovich et al., 2018). The music therapist should observe changes to client's heart rate throughout the intervention. If any discomfort is observed, the music therapist should match the client's heart rate again and start the process over. This process of decreasing the track's tempo by five beats every minute can be repeated to get the client's resting heart rate to an acceptable level, 60 to 100 beats per minute.

Music Assisted Relaxation

Music Assisted Relaxation is used within the muscle and joint pain, injection and surgical pain, abdominal pain, and multiple pain areas session protocols. This intervention includes the music therapist playing live or recorded sedative music, following the musical rationale outlined in the therapeutic functions of music (TFM) (See Table 6) and verbally guiding the client through deep and slow breathing. Music assisted relaxation has been successful in reducing pain for individuals in acute pain experiencing menstrual muscle cramps, in the emergency department, post-surgery, and palliative care (Gutgsell et al., 2013; Mandel et al., 2019; Martin-Saavedra & Ruiz-Sternberg, 2020; Sand-Jecklin & Emerson, 2010).

The music therapist developed two different music assisted relaxation tracks for music therapy use. One music assisted relaxation targets slow breathing and the other targets

stimulation of the vagus nerve. Researchers have found slow breathing and the vagus nerve have a role in triggering the parasympathetic nervous system and relaxing the body (Russo et al., 2017).

Russo et al. (2017) defined slow breathing as any rate between four and 10 breaths per minute, with a regular respiration rate of 10 to 20 breaths per minute. Slow breathing has many positive effects on the body including decreasing mean blood pressure, increasing breathing efficiency, increasing heartrate and breathing synchronicity, and increasing vagus nerve stimulation (Bora et al., 2017; Russo et al., 2017). Russo et al. found heartrate and breathing synchronicity, generally initiated by the vagus nerve, maximizes around six breaths per minute which can induce an individual's relaxation response.

Using this research, the music therapist developed slow breathing and vagus nerve stimulation music assisted relaxation tracks. The tracks have a tempo of 45 beats per minute and guide the listener through six breaths per minute for a five-minute duration. The recording instructs the listener to breathe in on a I chord in the key of D arpeggiated on the guitar using the pattern D, A, F#, A, high D, A, F#, A. Following instructing the listener to breathe out on a V chord in the key of D arpeggiated on the guitar using the same pattern A, E, C#, E, high A, E, C#, E. The music therapist provides a supportive voice guiding the listener through the first few breaths and gradually fades the support voice so that the listener is listening and breathing on their own. The simple texture of the music continues throughout the tracks. For implementation, the music therapist suggests that the track be used or the music therapist implementing the intervention use live music that mimics the musical texture and supportive voice in the track.

The vagus nerve stimulation track is similar to the slow breathing track with the musical texture guiding the listener when to breathe in and out to ensure the six breathes per minute.

However, the music in the vagus nerve stimulation track has lower frequencies. Researchers have found that frequencies around five-10 Hz have shown to stimulate the vagus nerve (Bonaz et al., 2017; Clarencon et al., 2014; Reyt et al., 2010). Therefore, the music therapist used a synthesizer for the pedal tones throughout the track, D0 and D-1 which equal 18.35Hz and 9.17Hz respectively. To further vagus nerve stimulation, the music therapist prompts the listener to hum on the exhale. The vagus nerve is the longest nerve in the body, starting in the brain and running through the face, chest, and into the abdomen. The vagus nerve is connected to the vocal chords and the muscles in the back of the throat. Therefore, the vagus nerve can be stimulated through singing, chanting, gargling, and humming (Vickhoff et al., 2013). The lower frequency notes and humming serve to further stimulate the vagus nerve along with the slow breathing to induce the parasympathetic, rest and digest, response. For implementation, the music therapist suggests that the track be used or for live implementation that a synethesizer be used so that low frequencies can be played, and the music therapist follow the musical structure of leading the client in breathing in and humming on the exhale for effective music assisted relaxation.

Guided Imagery with Music

Guided Imagery with Music is used with the Tension Headache session protocol. Several studies have been conducted to demonstrate the efficacy of guided imagery and music when reducing pain, anxiety, depression, stress, medication use, and improving quality of life for individuals with musculoskeletal disabilities (Baird and Murawski, 2010; Kaplun, 2020; Lewandowski, 2011; Menzies et al., 2014; Onieva-Zafra, 2015; Torres, 2018). Guided imagery and music have also had a positive impact on frequency and duration of pain in individuals experiencing chronic daily headaches (Smyrnioti et al., 2022). Guided imagery has reduced tension headache frequency, duration, and intensity for individuals receiving it compared to

individuals participating in a happy memory group, where participants were encouraged to think of some of their happiest memories in their lifetime instead of following a guided imagery script (Abdoli et al., 2012). Individuals receiving guided imagery reported that their headaches were much better by a decrease in frequency and severity than those in the control group (Mannix et al., 1999).

There are several different guided imagery scripts available online and easily accessible. The music therapist wrote a guided imagery script (See Appendix) to assist with the implementation of the protocol and is read over the guided imagery backing track developed by the music therapist as well. The track can be used in its original form with the developing music therapists voice reading the guided imagery script or for live implementation, the music therapist can use the music backing track and read the guided imagery script themselves along with it.

Throughout the track there are several examples of "word painting" defined by Patel (2008) as when the instrumentation, melody, and harmony "reflect some aspect of word meaning" (p. 342). Similarly, to the music assisted relaxation tracks, the listener is guided to breath in on a I chord in C major with an arpeggiated piano accompaniment of the notes C, E, G, B, C, B repeated twice. Followed by breathing out on a V7 chord with a similarly arpeggiated piano accompaniment of the notes G, B, D, F, D, F. After the breathing, the music therapist has the listener imagining a balloon attached to the specific area of tension and having the balloon pull the tension out of the listeners head while it floats into the air and disappears. As the balloon floats away with the tension, musically the melody in the chimes begins to ascend and the texture is immediately reduced when the balloon disappears. The music therapist then has the listener imagine something cool on their forehead. Musically, the music therapist uses a xylophone and a descending melody as the coolness seeps further from the forehead, into the face, eyes, cheeks,

and head. Finally, the music therapist has the listener to feel relaxation and introduces the harp as a new instrument. The harp and piano have been doubled to create an airy feeling when welcoming relaxation. Finally, the guided imagery ends with the listener allowing relaxation to grow throughout their body. Musically, the arpeggiated piano motif returns to support the spreading of relaxation.

Music Alternate Engagement

Music Alternate Engagement is used within the Injection and Surgical Pain session protocol. Tan et al. (2010) used Music Alternate Engagement (MAE) to distract individuals from pain when undergoing burn dressing changes. These techniques included active participation in music making such as playing instruments, singing, breathing, and receptive listening. MAE music therapy technique was successful in distracting patients from the pain of dressing changes and resulted in decreased pain levels before, during, and after the procedure (Tan et al., 2010). In a study by Kant and Akpinar (2017), 91% of individuals that received music during intramuscular injections said they were satisfied with the procedure and experienced lower pain scores which was significantly significant against the control groups. The music techniques included recorded Turkish music without lyrics at 60-80 dB to distract from intramuscular injections. Similarly, patients listening to preferred music while receiving corticosteroid injections through a portable speaker experienced a significantly greater decrease in pain than those that did not listen to music while receiving injections (Li et al., 2020). Music can distract painful procedures and result in reduced pain during procedures and less perceived pain after injections or procedures.

The music therapist designed the Music Alternative Engagement track with a slower tempo, 65 beats per minute to still provide relaxation to the listener and not overwhelm them.

The track is written in binary form, AABBAA to provide a call and response like structure for music therapist and client to engage in together. The call and response allow for the client to rest if needed and provides a natural feel for collaboration between client and music therapist. The music therapist chose for many of the melodic phrases of the instrumentation in the track are a descending C scale, to provide a sinking relaxation feeling much like the descending phrases in the guided imagery track. For implementation, the music therapist recommends the track be used with drums or other percussive instruments. Melodic instruments using a pentatonic C scale can also be used along with the backing track.

Patient Preferred Therapeutic Music Listening

Patient Preferred Therapeutic Music Listening is used within the Muscle and Joint Pain and Abdominal Pain session protocols. The music therapist should conduct patient preferred therapeutic music listening using information gathered from the ACP-SPAA. The use of relaxing patient preferred music has reduced the opioid consumption for individuals after operation, reduced menstrual muscle cramps, and stimulated pain (Ebneshahidi & Mohseni, 2008; Martin-Saavedra & Ruiz-Sternberg, 2020; Nilsson, 2008). Individuals recovering from abdominal surgery who listened to preferred music after surgery reported less pain intensity and pain distress than those in the control group. Also, those who took part in the receptive music intervention post abdominal surgery had lower systolic and diastolic blood pressure, heart rate, and respiratory rate than those in the control group (Vaajoki et al., 2013). Researchers have also found participants listening to recorded preferred music had higher pain thresholds and lower pain scores than individuals that listened to unpreferred music (Timmerman et al., 2023).

The music therapist included the use of patient preferred music due to the effectiveness it has shown in the research of reducing pain. Recorded patient preferred music should be used

when available and appropriate to preserve the authenticity of the client's preferences. However, the implementing music therapist can play patient preferred music for the client live when certain musical elements are not being met. Implementing music therapists should refer to the therapeutic function of music (See Table 6) and make decisions on how to best use patient preferred music for pain management with their specific client.

Expression of Pain and Healing Through Instrument Playing

While different areas and types of pain can have different approaches on how to treat them, pain can also be experienced in many different areas and sources all at the same time. Therefore, there needs to be an intervention that provides a more comprehensive approach for individuals that are experiencing several different priority areas of pain. In this intervention, the music therapist asks the client to pick an instrument that could represent their pain and an instrument to represent their healing. The client begins by playing that instrument and then the music therapist validates the client's pain by playing that same instrument. After the expression of pain, the music therapist moves into entrainment with the client.

Finally, the music therapist finishes the music assisted relaxation playing the instrument the client picked to represent their healing. This intervention allows the music therapist to validate the clients pain and healing journey while supporting them through music. The healing instrument could remind the client of a happy memory such as an ocean drum reminding them of the beach or an instrument that the client finds relaxing to listen to.

Muscle and Joint Pain Interventions and Tension Headache Session Protocols

Table 1 presents the session interventions for muscle and joint pain management. After preparing the environment and completing the Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA), the implementing music therapist will begin entrainment and iso-

principle with the client. This intervention should be conducted for five to 10 minutes depending on the client's beginning heart rate assessed by the pulse oximeter. The duration of five to 10 minutes allows for the client's heart rate to be entrained to the music and decreased anywhere between 15 to 40 beats per minute. Starting with entrainment allows for the client to prepare for the rest of the pain management session with a normal resting heart rate.

Continuing with the muscle and joint pain management session, the implementing music therapist will conduct music assisted relaxation after entrainment. The music assisted relaxation tracks made by the music therapist are six minutes long. However, during implementation they can be looped again for longer slow breathing or vagus nerve stimulation interventions.

Researchers have found music assisted relaxation to be beneficial for pain management in a span of durations from five to 88 minutes (Gutgsell et al., 2013; Mandel et al., 2019; Martin-Saavedra & Ruiz-Sternberg, 2020; Sand-Jecklin & Emerson, 2010). Therefore, the music therapist has designed the music assisted relaxation tracks with the ability to be looped and manipulated to adjust musical elements as needed such as changing the tempo, the timbre of the instruments, reducing the texture, etc. Consideration for potential manipulations of the track has been included in the time span of the session outline to fit within the 30 minutes allotted for the pain management session.

Following music assisted relaxation in the muscle and joint pain session outline, the implementing music therapist will conduct patient preferred therapeutic music listening with the client. Researchers have found patient preferred music yields overwhelmingly positive results for pain management in general (Ebneshahidi & Mohseni, 2008; Martin-Saavedra & Ruiz-Sternberg, 2020; Nilsson, 2008; Timmerman et al., 2023). Music acts as a distraction while the client listens to their favorite artists or genres of music. Similar to music assisted relaxation, listening to

patient preferred music has had positive effects on pain management in a span of durations from ten to 30 minutes (Ebneshahidi & Mohseni, 2008; Martin-Saavedra & Ruiz-Sternberg, 2020; Nilsson, 2008; Thakare et al., 2022; Timmerman et al., 2023). Therefore, the music therapist chose a duration that fit specifically into the 30-minute session.

Table 1

Muscle and Joint Pain Session Protocol

Intervention	Time	Description
Preparing the Environment	~5 minutes	1. Completing Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA) 2. Adjusting the lights 1. Closing door if appropriate 4. Offering comfortable items (ie. Blanket, pillow, etc.) 5. Turning off cell phones and other items that make noise.
Entrainment and Iso-prinicple with client	~5-10 minutes	1. Live or recorded music to manipulate the client's vital signs. 2. Use pulse oximeter to determine client's initial heart rate. 3. Allow the heartbeat music entrainment track to play for two minutes. 4. Reduce the tempo of the track by five beats per minute. 5. Constantly observe client for changes in heart rate and any signs of discomfort 6. Process is repeated of decreasing tracks tempo by five beats every minute until clients resting heart rate is at an acceptable level, 60-100 beats per minute.
Music Assisted Relaxation	~5-10 minutes	1. Live or specifically recorded sedative music with verbally guided deep slow breathing. 2. Clinically decide to use the slow breathing or vagus nerve music assisted relaxation music track. 3. Play the specific music track with recorded voice or play music track with just instrumentation and verbally guide the client through the slow breathing. 4. For live implementation of slow breathing, while playing an arpeggiated I chord have the client inhale for 5 seconds. Then while playing an arpeggiated V chord have the client exhale for 5 seconds. Process repeats for 5-10 minutes. 5. For live implementation of vagus nerve, conduct the same music and breathing as the slow breathing instructions. On the exhale have the client hum. Use a synthesizer to play low frequencies around 5 to 10 Hz.
Patient Preferred Therapeutic Music Listening	~10 minutes	1. Patient preferred music gathered from ACP- SPAA. 2. Recorded patient preferred music should be used when available and appropriate. 3. However, can be played live to meet certain musical elements (See Table 6).
Closing	~2 minutes	1. Slowly fading patient preferred music. 2. If patient is sleeping, slowly walking out of room without disturbing patient. 3. If patient is still awake, sitting in silence for approximately 1 minute or however long seems appropriate. 4. Thanking the patient for participating in music therapy and asking them if they need anything. 5. Quietly exit the room.

Note. This table depicts the session protocol for the muscle and joint pain priority area. The pain reduction interventions should be completed in order from top to bottom following the steps outlined in the description column.

Tension Headache Pain Session Protocol

Table 2 presents the session interventions for tension headache pain management. Like the muscle and joint pain session, after preparing the environment and completing the Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA), the implementing music therapist will begin entrainment and iso-principle with the client. After entrainment and iso-principle with the client, the implementing music therapist will begin the guided imagery with music.

The guided imagery backing track created by the music therapist is 17 minutes and 24 seconds long. This coincides with the planned intervention time within the session of around 20 minutes for guided imagery. The music therapist recommends using the guided imagery track with the implementing music therapists voice reading the script for the client. However, the implementing music therapist can use the track however they see fit. If the implementing therapist wants to create their own guided imagery script and music track the music therapist recommends keeping the intervention to roughly a 20-minute time span. Researchers have found guided imagery and music in 20 to 30-minute increments has been successful in the reduction of tension headache frequency, duration, and intensity (Abdoli et al., 2012; Mannix et al., 1999; Smyrnioti et al., 2022).

Table 2

Tension Headache Pain Session Protocol

Intervention	Time	Description
Preparing the environment	~5 minutes	1. Completing Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA) 2. Adjusting the lights 3. Closing door if appropriate 4. Offering comfortable items (ie. Blanket, pillow, etc.) 5. Turning off cell phones and other items that make noise.
Entrainment and Iso-principle with Client	~5-10 minutes	1. Live or recorded music to manipulate the client's vital signs. 2. Use pulse oximeter to determine client's initial heart rate. 3. Allow the heartbeat music entrainment track to play for two minutes. 4. Reduce the tempo of the track by five beats per minute. 5. Constantly observe client for changes in heart rate and any signs of discomfort 6. Process is repeated of decreasing tracks tempo by five beats every minute until clients resting heart rate is at an acceptable level, 60-100 beats per minute.
Guided Imagery with Music	~20 minutes	1. Using recorded sedative and soothing music with verbally guided imagery script. 2. Play the guided imagery and music track instrumentally and read the guided imagery script (See Appendix)
Closing	~2 minutes	1. Slowly fading patient preferred music. 2. If patient is sleeping, slowly walking out of room without disturbing patient. 3. If patient is still awake, sitting in silence for approximately 1 minute or however long seems appropriate. 4. Thanking the patient for participating in music therapy and asking them if they need anything. 5. Quietly exit the room.

Note. This table depicts the session protocol for the tension headache pain priority area. The pain reduction interventions should be completed in order from top to bottom following the steps outlined in the description column.

Injection and Surgical Pain Session Protocol

Table 3 presents the session interventions for injection and surgical pain management. After preparing the environment and completing the Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA), the implementing music therapist will begin music alternate engagement. Music alternate engagement allows for the music to serve as a distraction to the injections or surgery taking place. Therefore, the music alternate engagement intervention should take up the majority of the session.

The music alternate engagement track created by the music therapist is seven minutes and 31 seconds long with the potential to be looped so that it can be used for all injections or surgeries taking place. Botoxillium injections can be a quick procedure lasting "three to five minutes" (J. Hand, personal communication, March 18, 2023), while baclofen pump refills can take approximately 15 minutes (University of Rochester Medical Center, 2023). With the use of the track, the implementing music therapist can create a call and response type of instrument playing to provide a distraction to the procedure. However, if the implementing music therapist wishes to make their own music alternate engagement backing track or manipulate the given music track developed by the music therapist using GarageBand, the music therapist suggests still adhering to the musical elements outlined by the therapeutic function of music (See Table 6) while adding drums to drive the beat. In the music therapist's backing track, the drum set is playing four on the floor to keep a continuous driving texture to illicit instrument playing.

After the music alternate engagement, the implementing music therapist will conduct music assisted relaxation. Providing music assisted relaxation after the alternate engagement induces the client's relaxation response and allows the parasympathetic nervous system to begin the rest and digest process. Activating the parasympathetic nervous system begins the recovery

process to heal the client from the injections or surgery they just endured (Cleveland Clinic, 2023)

Table 3

Injection and Surgical Pain Session Protocol

Intervention	Time	Description
Preparing the environment	~5 minutes	1. Completing Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA) 2. Adjusting the lights (if possible) 3. Closing door (if possible) 4. Offering comfortable items (ie. Blanket, pillow, etc.) 5. Turning off cell phones and other items that make noise.
Music Alternate Engagement	~15minutes or length of the injection/surgery	1. Using instrument playing, singing, and other active music therapy techniques to engage client in distraction from procedure. 2. Play the music alternate engagement track and engage the client in active music making. 3. Follow the call and response form of the recording taking turns in between the client and music therapist. 4. Recommend using drums or other percussive instruments when implementing. 5. Melodic instruments using a pentatonic C scale can also be used with the track.
Music assisted relaxation	~10 minutes	1. Live or specifically recorded sedative music with verbally guided deep slow breathing. 2. Clinically decide to use the slow breathing or vagus nerve music assisted relaxation music track. 3. Play the specific music track with recorded voice or play music track with just instrumentation and verbally guide the client through the slow breathing. 4. For live implementation of slow breathing, while playing an arpeggiated I chord have the client inhale for 5 seconds. Then while playing an arpeggiated V chord have the client exhale for 5 seconds. Process repeats for 5-10 minutes. 5. For live implementation of vagus nerve, conduct the same music and breathing as the slow breathing instructions. On the exhale have the client hum. Use a synthesizer to play low frequencies around 5 to 10 Hz.
Closing	~2 minutes	1. Slowly fading patient preferred music. 2. If patient is sleeping, slowly walking out of room without disturbing patient. 3. If patient is still awake, sitting in silence for approximately 1 minute or however long seems appropriate. 4. Thanking the patient for participating in music therapy and asking them if they need anything. 5. Quietly exit the room.

Note. This table depicts the session protocol for the injection and surgical pain priority area. The pain reduction interventions should be completed in order from top to bottom following the steps outlined in the description column.

Abdominal Pain Session Protocol

Table 4 presents the session interventions for abdominal pain management. After preparing the environment and completing the Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA), the implementing music therapist will begin patient preferred therapeutic music listening. Researchers have found patient preferred music yields overwhelmingly positive results for pain management in general (Ebneshahidi & Mohseni, 2008; Martin-Saavedra & Ruiz-Sternberg, 2020; Nilsson, 2008; Timmerman et al., 2023). It is one of the leading interventions when treating abdominal pain (Dale, 2021; Kahloul et al., 2017; Vaajoki et al., 2013). Therefore, the music therapist chose to make patient preferred music the first intervention in the abdominal pain management session.

After patient preferred music, the implementing music therapist will conduct entrainment and iso-prinicple with the client followed by music assisted relaxation. The music therapist recommends the vagus nerve stimulation music assisted relaxation be used for the abdominal pain session. Due to the vagus nerve stretching from the brain all the way into the abdomen, researchers have found vagus nerve stimulation has improved abdominal pain (Bonaz et al., 2017; Shi et al., 2021)

Table 4

Abdominal Pain Session Protocol

Intervention	Time	Description
Preparing the environment	~5 minutes	1. Completing Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA) 2. Adjusting the lights 3. Closing door if appropriate 4. Offering comfortable items (ie. Blanket, pillow, etc.) 5. Turning off cell phones and other items that make noise.
Patient Preferred Therapeutic Music Listening	~10 minutes	1. Patient preferred music gathered from ACP- SPAA. 2. Recorded patient preferred music should be used when available and appropriate. 3. However, can be played live to meet certain musical elements (See table 6).
Entrainment and Iso- principle with Client	~5-10 minutes	1. Live or recorded music to manipulate the client's vital signs. 2. Use pulse oximeter to determine client's initial heart rate. 3. Allow the heartbeat music entrainment track to play for two minutes. 4. Reduce the tempo of the track by five beats per minute. 5. Constantly observe client for changes in heart rate and any signs of discomfort 6. Process is repeated of decreasing tracks tempo by five beats every minute until clients resting heart rate is at an acceptable level, 60-100 beats per minute.
Music assisted relaxation	~5-10 minutes	1. Live or specifically recorded sedative music with verbally guided deep slow breathing. 2. Clinically decide to use the slow breathing or vagus nerve music assisted relaxation music track. 3. Play the specific music track with recorded voice or play music track with just instrumentation and verbally guide the client through the slow breathing. 4. For live implementation of slow breathing, while playing an arpeggiated I chord have the client inhale for 5 seconds. Then while playing an arpeggiated V chord have the client exhale for 5 seconds. Process repeats for 5-10 minutes. 5. For live implementation of vagus nerve, conduct the same music and breathing as the slow breathing instructions. On the exhale have the client hum. Use a synthesizer to play low frequencies around 5 to 10 Hz.
Closing	~2 minutes	1. Slowly fading patient preferred music. 2. If patient is sleeping, slowly walking out of room without disturbing patient. 3. If patient is still awake, sitting in silence for approximately 1 minute or however long seems appropriate. 4. Thanking the patient for participating in music therapy and asking them if they need anything. 5. Quietly exit the room.

Note. This table depicts the session protocol for the muscle and joint pain priority area. The pain reduction interventions should be completed in order from top to bottom following the steps outlined in the description column.

Multiple Pain Areas Session Protocol

Table 5 presents the session interventions for multiple pain areas pain management. After preparing the environment and completing the Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA), the implementing music therapist will begin the instrument playing intervention for the expression of pain. Since the other interventions have localized pain areas, they have a more localized approach with interventions that work specifically to heal the type of pain being experienced. These interventions are used for a more holistic approach to pain experienced in multiple places at once.

This approach allows the client to take ownership of their pain and support them through a journey to find relief. Due to the more holistic approach, the music therapist included entrainment and music assisted relaxation which are the most common interventions for pain management and used in all the interventions that are targeting specific pain. After the music assisted relaxation, the implementing music therapist plays the clients chosen healing instrument to finalize their healing journey.

The music therapist suggests for the implementing music therapist to decide which intervention might be best for their client as reflected by the Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA). If the client is experiencing headaches, complete the Guided Imagery and Music intervention using the backing track. If the client is experiencing abdominal pain, conduct the vagus nerve stimulation music assisted relaxation. This session might not be conducted the same for each client. The music therapist suggests conducting interventions that will best serve the needs of the client.

Table 5

Multiple Pain Areas Session Protocol

Intervention	Time	Description
Preparing the environment	~5 minutes	1. Completing Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA) 2. Adjusting the lights 3. Closing door if appropriate 4. Offering comfortable items (ie. blanket, pillow, etc.) 5. Turning off cell phones and other items that make noise.
Expression of Pain and Healing through Instrument playing	~5 minutes	1. Ask the client to imagine the sound of the pain through musical instruments. 2. Ask the client to imagine the sound of healing music. 3. Therapist validates the client's pain by playing the pain music while client indicates various aspects of the pain.
Entrainment and Iso- principle with Client	~5-10 minutes	1. Live or recorded music to manipulate the client's vital signs. 2. Use pulse oximeter to determine client's initial heart rate. 3. Allow the heartbeat music entrainment track to play for two minutes. 4. Reduce the tempo of the track by five beats per minute. 5. Constantly observe client for changes in heart rate and any signs of discomfort 6. Process is repeated of decreasing tracks tempo by five beats every minute until clients resting heart rate is at an acceptable level, 60-100 beats per minute.
Music assisted relaxation	~5 minutes	1. Live or specifically recorded sedative music with verbally guided deep slow breathing. 2. Clinically decide to use the slow breathing or vagus nerve music assisted relaxation music track based on what pain areas are being affected. 3. If experiencing abdominal pain, conduct the vagus nerve stimulation music assisted relaxation. 4. Play the specific music track with recorded voice or play music track with just instrumentation and verbally guide the client through the slow breathing. 5. For live implementation of slow breathing, while playing an arpeggiated I chord have the client inhale for 5 seconds. Then while playing an arpeggiated V chord have the client exhale for 5 seconds. Process repeats for 5-10 minutes. 6. For live implementation of vagus nerve, conduct the same music and breathing as the slow breathing instructions. On the exhale have the client hum. Use a synthesizer to play low frequencies around 5 to 10 Hz.
Expression of Healing through Instrument playing	~10 minutes	1. Therapist validates clients healing process by playing their chosen healing instrument.
Closing	~2 minutes	1. Slowly fading patient preferred music. 2. If patient is sleeping, slowly walking out of room without disturbing patient. 3. If patient is still awake, sitting in silence for approximately 1 minute or however long seems appropriate. 4. Thanking the patient for participating in music therapy and asking them if they need anything. 5. Quietly exit the room.

Note. This table depicts the session protocol for the muscle and joint pain priority area. The pain reduction interventions should be completed in order from top to bottom following the steps outlined in the description column.

Musical Rationale

All music used throughout the session protocols should follow the guidelines of the Therapeutic Functions of Music (TFM). Hanson-Abromeit (2015) developed the Therapeutic Function of Music Plan to properly define the musical elements and how they work therapeutically within music therapy interventions. The TFM helps music therapist remain cognizant when planning to create a music and goal driven intervention using the theoretical elements of music Hanson-Abromeit (2015). The TFM table for music with the specific goal of pain management is outlined in Table 6. The table includes the musical element, the theoretical framework, the purpose of the musical element and a description of the musical element.

Table 6

Musical Rationale TFM Table

Musical Element	Theoretical Framework	Purpose of Musical Element	Description of Musical Element
Melody	Major mode music has a greater effect of reducing cortisol levels during stressful conditions than minor mode music (Suda et al., 2008)	The brain commonly associates major music with the mood happy and minor music with the mood sad. Major modes should be used to reduce cortisol levels and stress hormones.	Music used throughout intervention should be composed in a major key.
Harmony	Natural position and progressions produce high harmonic consonance making them more enjoyable (Martin-Saavedra, 2020).	Consonance can give the effect of stability while dissonance can give the opposite effect. Giving the effect of stability allows the client to feel safe and able to relax.	Music used throughout intervention should be consonant. Meaning it should give the impression of stability rather than tension or dissonance.
Lyrics	Music without lyrics is effective in the management of pain showing acceptable heterogeneity in a qualitative meta-analysis (Martin-Saavedra, 2018).	The absence of lyrics can support the client into their relaxation state without distraction. Lyrics should be used only when necessary to guide the client into the relaxation process.	Music used throughout intervention should mostly consist of only instrumental music. The absence of lyrics should be used when possible.
Tempo	Slow and flowing music with 60 to 80 beats per minute has been observed to have positive outcomes on relaxation and pain relief (Nilsson, 2008).	Tempo should be modified to reflect the client's needs. For relaxation, tempo should stay within the appropriate range to support relaxation and pain relief.	Music should be within 60 to 80 beats per minute.
Dynamics	Individuals demonstrated preferences towards soft music (60-70 dB) rather than medium (70-80 dB) or loud (80-90 dB) music (Staum & Brotons, 2000).	Dynamics remain in the appropriate range to keep the music enjoyable and promote a relaxation response.	Music should not exceed a maximum volume level of 60 dB.

Note. This table depicts the therapeutic function of music with the goal of pain management and alleviation. The music therapist should follow all recommendations outlined in the description of the musical elements.

Chapter Five

Discussion

The Management for Differing Types of Pain in Cerebral Palsy: Music Therapy Protocol presents specific pain management music therapy assessment and interventions within sessions to provide pain relief to individuals with cerebral palsy. This project's purpose was to develop an individualized protocol on how to use music therapy for pain management and reduction with individuals with cerebral palsy. The sessions outline 30 minutes of music therapy interventions to alleviate specific types of pain for clients with cerebral palsy with reminders to music therapists to constantly assess for pain and discomfort within sessions.

Along with the protocol, the music therapist developed five music tracks to accompany the interventions presented within the protocol. The music therapist developed a guided imagery backing track, heartbeat entrainment track, slow breathing music assisted relaxation track, vagus nerve stimulation backing track, and an alternative music engagement backing track. The music therapist synthesized all research found on specific musical elements that reduce pain and used these parameters when creating each track. Each music track can be manipulated within GarageBand to best fit the needs of each client.

Each music track was created in GarageBand on a MacBook Air (M1, 2020) version 12.5.1. The music therapist used GarageBand to create the tracks so that implementing music therapists could manipulate the tracks to fit their client's needs in sessions. Instrumentation in the tracks include piano, guitar, synthesizers, harp, xylophone, drum set, and voice. Along with manipulation of music tracks within GarageBand, the implementing music therapist can manipulate the TFM table to meet the needs of their individual clients. The Management for

Differing Types of Pain in Cerebral Palsy: Music Therapy Protocol should look different for each client to create a treatment plan that serves the client.

Limitations

For completion of the Adults with Cerebral Palsy: Specific Pain Areas Assessment (ACP-SPAA), clients must have the cognitive ability to rate their pain on a scale from zero to 10 or have access to a caregiver that could properly understand their pain and be able to accurately complete the assessment for them. Another limitation is that this protocol has not been assessed on actual clients yet. The Management for Differing Types of Pain in Cerebral Palsy: Music Therapy Protocol was created from a synthesis of literature around what is known about music therapy and pain as well as music therapy and cerebral palsy since there is limited research available examining the relationship between using music therapy as an analgesic tool for individuals with cerebral palsy.

Since all music tracks were created in GarageBand, the implementing music therapist must have GarageBand to access them. Without access to the tracks the implementing music therapist cannot manipulate the tracks. However, the implementing music therapist can use MP3 versions of the music tracks. The basic structure of the music tracks has also been provided by the music therapist so the reader can play them live, if needed.

Suggestions for Future Research

The Management for Differing Types of Pain in Cerebral Palsy: Music Therapy Protocol can be used in future case study, qualitative, or quantitative research studies. With future implementation, music therapy can grow into a more widely accepted analgesic method for pain management in general as well as for individuals with cerebral palsy. With more research, individuals with cerebral palsy can find non-invasive and non-addictive pain relief and their

caregivers can find relief in knowing they are not in chronic pain. Further researchers can assess the feasibility of the assessment tool and the effectiveness of the pain interventions with a large population to create more rationale for music therapy as an analgesic method for pain management when working with individuals with cerebral palsy. An assessment tool for pain in adults with cerebral palsy that do not have the cognitive ability to rate their pain should be developed. A similar protocol for pain management music therapy interventions for children with cerebral palsy should be developed.

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APPENDIX A:

Guided Imagery Script

Guided Imagery Script

Let's start by finding as comfortable a position as you can where you are. Feel the support underneath you and let yourself settle into it. Feel like you can adjust your position at any point to become more comfortable.

When you feel comfortable, start to pay attention to your breathing. Take a deep breath in, filling your lungs as comfortably as you can. And feel the air leave and relax your body as it exits out of your mouth.

Try to feel your belly grow while you breathe in if comfortable and breathe all the way out.

Again, breathe in through your nose, filling your lungs with air.

And out letting the exiting stream of air sooth you.

Breathe In……. and Out…… Breathe In…… and Out ……. Breathe In and Out…….

Breathe in fully and on this last exhale, let any negative, sad, or unwelcome thoughts float on the air while it exits your body. So now that you have exhaled, your mind is clear and free.

Continue to deep breathe. We will come back to the breath throughout the process.

Now turn your attention to your headache.

Where is the pain specifically located? Still paying attention to your breathing, imagine breathing in relief, cleansing, healing air into that specific area and exhaling the tension and pain held in that spot.

Breathe in relief…… Breathe out tension…….

Direct to that spot

Breathe in relief…… Breathe out tension…….

Breathe in relief…… Breathe out tension…….

Breathe in relief…… Breathe out tension…….

Now imagine from that specific spot, there is a deflated balloon and string tied to the tension. Gradually the balloon starts to be filled with air. And the balloon starts to rise higher and higher. With the balloon rising hiring, it starts to gently pull the tension away from your body. The balloon rises out from the top of your head taking the tension pain discomfort with it. You watch the balloon float into the sky until you see it disappear from your view. Allowing the tension to disappear with it.

Now leaving this localized spot. Draw your attention to your forehead. Imagine your forehead is cool. Like a wet cloth is on your forehead, a cool fan blowing on your face, or an ice cube is just a few inches away from your skin. You can feel the cool sensation start to penetrate your skin. The coolness feels nice and refreshing. Sit for a moment allowing the coolness to affect your whole forehead.

Now allow for the coolness to seep down into your eyebrows. It is cool enough to make some of your eyebrow hairs stand up. Let it to start to travel to your eyes and into your cheeks. Finally allow the coolness to be felt in the sides and back of your head. The cool sensation is nice and allows some tension release and pain relief. The cool sensation starts to bring relaxation.

You first feel the relaxation at the top of your head. Be aware of how the relaxation feels. Does it feel floaty, heavy, tingly, warm? With each deep breath you take allow for the relaxation to grow. Let the relaxation begin to give you pain relief. What was once only on the top of your head, has now spread to your forehead…. to your eyebrows…. to your eyes…. your cheeks…. your ears…., your chin..., the back of your head. Feel the relaxation encompass your head.

Now allow the relaxation to grow more. Encompassing the back of your neck…. the front of your neck… the sides of your neck. Let it spread into your shoulders. Into the top of your shoulders and into between your shoulder blades. Take a few deep breaths and allow yourself to sink further into the feeling of relaxation, whether that be a floaty feeling, a heavy feeling, a tingly feeling, a warm feeling.

In……. and Out…… In…… and Out ……. In and Out…….

Allow the relaxation in your head, shoulders and neck to grow even more now with each breath. Let it flow into your arms. Let your arms feel warm reaching all the way into your hands and fingers. Allow them to feel warm and heavy. Let the relaxation extend from your shoulders into your back and finally into your legs. Allow the relaxation to reach all the way down your legs into your feet and toes. Feel the warmth in your arms and legs begin to feel heavy and let go as they get warmer and warmer. Heavier and heavier.

Your entire body feels relaxed, free, and comfortable.

Let any pain or discomfort that has not yet been melted away leave your body through your exhales as we concentrate on our breathing again.

Try to feel your belly grow while you breathe in if comfortable and breathe all the way out.

Again, breathe in through your nose, filling your lungs with air.

And out letting the exiting stream of air sooth you.

Breathe In…….. and Out……

Breathe in relief…… Breathe out tension…….

We have completed the relaxation script for headache relief. I will slowly count from 5 to 1 and you can decide to open your eyes or drift off to sleep. If you choose to open your eyes, imagine becoming more alert and awake with each number I say. If you choose to sleep, allow your eyelids to get heavier and drift off into a deeper sleep with each number I say.

5…… 4…… 3…… 2…. 1.