Abstract

Comfort holds and focal points are used for pediatric patients receiving injections so that their perception of pain will decrease during the procedure. The purpose of this study is to determine whether the addition of music therapy is more effective in facilitating the reduction of pediatric pain perception during injections.

An experimental group of 19 pediatric patients ranging from age 2 to 10 years were randomly selected to receive music therapy during their injections. The intervention began when the patient entered the immunization room of the Rap Clinic at University Hospitals of Cleveland and concluded when the patient left. The experimental group consisted of children from age 3½ to 10 years playing the kazoo to the tune of “I’ve Been Working on the Railroad.” The researcher would play a Q-chord set on EZ play with the sound effect on vibraphone. Next, the researcher would integrate into the lyrics of the song the child’s name, how s/he should play the kazoo (loud vs. soft), and incorporate holds at the end of each phrase to encourage an extended duration of sound. For children ages 2 and 3 years the researcher sang the “Barney Song” while tapping on a shiny tambourine. The tambourine was positioned to distract the child from looking at the location of the injection and to encourage the child to look at his eyes in the reflection of the tambourine or to look into the researcher’s eyes. The song was sung initially to match the child’s behavior and would progress to a relaxing tempo. If the child would cry, the researcher would hold the end of phrases to match the child’s breathing pattern.

The experimental group was then compared to a control group of 16 pediatric patients ages 2 to 10 years who did not receive music therapy. The experimental and control groups were matched on the basis of age. Statistical comparison revealed that the experimental group demonstrated a significant decrease in pain perception and less behavioral distress during the injections.

Introduction

Children between the ages of 0 to 10 years frequently receive immunology injections when they visit their family doctor. For younger children a visit to the doctor can be associated with getting a painful shot. There is a need to incorporate non-invasive methods of pain management for pediatric patients undergoing invasive medical
procedures in hope to decrease negative associations with medical staff, increase positive coping skills for invasive procedures, minimize suffering, and permit a successful and safe procedure.

There continues to be a growing interest in the medical profession to accurately assess pediatric pain in order to understand appropriate pain management strategies to lessen distress of pediatric patients. The purpose of this project is to determine if music can facilitate the pain management strategies that are currently being used during injections and whether the addition of music can further decrease pediatric pain perception during the procedure.

**Review of Relevant Literature**

*Defining Acute Pain in Pediatric Patients*

Brown, Chen, & Dworkin conducted a study to determine the benefits of music with regard to the control of human pain. Their study presents how defining pain is a challenging task for the medical community. The International Association for the Study of Pain defines pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.” (Brown, Chen, & Dworkin, 1989) This definition recognizes the subjective nature of pain, but others would argue that this definition is unsatisfactory because it does not take into consideration other biophysical elements. For example, Luciano, Vander, & Sherman define pain as, “A stimulus which causes or is on the verge of causing tissue damage often elicits a sensation of pain and a reflex escape or withdrawal response as well as a gamut of physiologic changes, e.g. faster heart rate, higher blood pressure, greater
secretion of epinephrine into the blood stream, increased blood sugar, dilated pupils and sweating.” (Luciano, Vander, & Sherman, p. 283) This definition establishes that pain physically is a response to stimulus, sociologically a threat that is a powerful means of learning, and psychologically a perception that translates physical stimulus into a perceived sensory experience that is highly subjective. (Brown, Chen, & Dworkin, 1989)

**Music and Pain Management**

This wide spectrum of sensitivity to pain makes it very difficult to measure and develop effective pain management strategies. Brown, Chen, Dworkin propose that actively listening to music in a structured fashion may yield a cognitive strategy that alters the perception of pain by involving attention-distraction, emotion, imagery, catharsis, and relaxation. Their research indicates that music has two attributes that are very useful for developing effective pain management skills: an attention-distraction dimension and an affect dimension. (Brown, Chen, Dworkin, 1989)

**Attention-distraction**

The attention-distraction dimension involves a sequence of sounds and silences occurring over time which enables it to have the potential of holding one’s attention, challenging one’s intellect, and modifying one’s emotional state regardless of one’s musical preference or knowledge. Brown, Chen, Dworkin continue to propose that the structure of music exists only through time and that it requires the individual to commit himself to the experience in the moment. They state that music cannot be interrupted without losing its intent, “Once begun, music must be continued without interruption in
order that a completed idea or expression may result; regardless of its length or
complexity or type and degree of skill it may require.” (Brown, Chen, Dworkin, 1989)

Affect dimension

Brown, Chen, Dworkin recognize that music has the potential of altering one’s
perception of time because the engagement in music has the potential to allow distraction
away from the reality of the moment, and from self-preoccupation. The research states
that the affect dimension is mood evoking and shows an enormous and potentially
unlimited range of active self-integrative experience. (Brown, Chen, Dworkin, 1989)
They claim that where words may be ineffective for communication, music is a personal
approach that can benefit the patient by providing an opportunity to non-verbally
demonstrate intent through a structured and communicative fashion.

Music as a Distraction

Live music has been proven to be very effective as a means of distraction for
pediatric patients receiving venipunctures, intravenous starts, and heel sticks. (Malone,
1996) Malone conducted a study that focused specifically on studying the effects of live
music on the distress of pediatric patients receiving venipunctures, intravenous starts, and
heel sticks. Results of the study indicated that all age groups appear to benefit from the
live music as an effective method of distraction. The patients that demonstrated the most
significant difference were children under the age of one. The distraction techniques
were less cognitively advanced than the music therapy approaches for older children;
rather, they attempt to soothe and relax the infant in order to distract him from his
surroundings. (Malone, 1996) The study also found that children tend to have similar responses to needles, regardless of the length of time the procedure takes. (Malone, 1996) Their initial responses usually predicted their subsequent behavioral distress; therefore, children who were more relaxed prior to the medical procedure demonstrated less behavioral distress during the intervention.

**Acute Pain in Pediatrics**

Chen, Joseph, and Zeltzer conducted a review of relevant literature on the acute pain experiences in pediatrics. They state that there is a wide range of behavioral and cognitive techniques that have been found to be effective for helping children to cope with acute pain. Their review shows how many existing interventions and assessment tools are reasonably easy to use, allowing practitioners to have the tools to identify children most vulnerable to pain and to significantly reduce pain-related distress in these children. (Chen, Joseph, & Zeltzer, 2000) Chen, Joseph, and Zeltzer state that there are three factors to assess pediatric pain: pain sensitivity, coping skills, and cognitive ability. (Chen, Joseph, & Zeltzer, 2000)

**Pain Sensitivity**

Chen, Joseph, and Zeltzer ascertained that pain sensitivity highly depends on children’s temperaments. Studies have shown that children with more pain-sensitive temperaments demonstrate increased reports of pain and anxiety during painful medical procedures. Significant differences in pediatric distress were found when those children received psychological interventions prior to the medical procedure. Their distress levels
were significantly lower with the psychological intervention, which suggests that the interventions may benefit most children who are pain sensitive. (Chen, Joseph, & Zeltzer, 2000)

**Coping Skills**

Chen, Joseph, and Zeltzer describe two coping characteristics that are common among children. The first type is defined as attenders, which describes children who prefer to be informed about medical procedure before it occurs. Distractors is the second type, they prefer not to be told anything about an upcoming procedure; rather, they prefer to be engaged in distracting tasks. Studies have shown that interventions that match a child’s preferred coping style prove to be more effective. (Chen, Joseph, & Zeltzer, 2000)

For example, children that were distractors, distracting intervention proved to increase their pain tolerance, and decreased their pain rating. Chen, Joseph, and Zeltzer suggest that assessment of the type of coping strategy a child utilizes prior to a medical procedure can then aid in the pain management interventions.

**Cognitive Ability**

Chen, Joseph, and Zeltzer state that the cognitive developmental level of children influences their ability to understand the concept of pain and their ability to express their experience in terms that researchers typically use to measure pain. (Chen, Joseph, & Zeltzer, 2000) Their studies show that children who are properly informed of upcoming
procedures display less behavioral distress during a medical intervention, when compared to children who receive developmentally advanced information.

Chen, Joseph, and Zeltzer declare that a child’s memory of a previous medical procedure can influence their response to a future one. Therefore, assessing pediatric patient’s understanding and memory of previous medical experiences could help to determine how they will respond to upcoming procedures.

The study suggests that medical professionals should utilize a comprehensive understanding of pediatric pain sensitivity, coping, and cognitive abilities because of the possible benefits the implementing of an appropriate and effective pain management strategy can have.

Comfort Holds

Barkey, Stephens, and Hall present a non-pharmacological model of pain management known as comfort holds that prove to aid in comforting children during invasive procedures. The development of this pain management intervention stemmed from the growing need to develop applicable pediatric pain management for patients undergoing invasive procedures such as venipunctures, heel sticks, and injections. (Barkey, Stephens, & Hall) The pain management intervention is divided into five stages. The first stage is preparing the child and parent/caregiver for the procedure and for their role during the procedure. The second is inviting the parent/caregiver to be present. The third is to utilize the treatment room for stressful procedures. The fourth is positioning the child in a comforting manner. Finally, the fifth is maintaining a calm and positive atmosphere. (Barkey, Stephens, & Hall)
**Purpose**

It is a common belief that typical health care environments do not have the financial capabilities or time availability to allow music therapy interventions to facilitate medical procedures, and yet there is a growing need to find practical methods of pain management for pediatric acute pain. This study is unique in that it works within the current structure of the health care environment of the Rap Clinic at University Hospitals of Cleveland.

The purpose of this study is to determine whether or not the addition of a music therapy technique that has the potential to be generalized, is more effective in facilitating the reduction of pediatric pain perception during injections.

The intervention begins when the patient enters the immunization room and concludes when the patient leaves. Because of the apparent benefits of music as a distraction, this study utilizes a technique that is simple and easy to generalize. Thus, it has the potential to be an effective and practical solution to the challenge that health care providers are facing.

**Method**

**Participants**

All of the 35 participants age 2 to 10 years were patients of the Rap Clinic at University Hospitals of Cleveland. This study was conducted in the immunology room between the hours of 9:30AM and 12:30PM Tuesday through Friday for three and a half months. The standard criteria for inclusion in the study were those patients that had
physician’s orders to receive immunology injection and had the ability to express behavioral distress.

Fifty-three percent of the subjects were female and 47% were male. Seven percent of the subjects were 2 years old, 9% were 3 years old, 13% were 4 years old, 9% were 5 years old, 11% were 6 years old, 9% were 7 years old, 11% were 8 years old, 20% were 9 years old, and 11% were 10 years old.

The following percentages represent the amount immunizations each age group received; fifty percent of children 2 years of age had 4 injections, 33% of 3 year olds had 2 injections, 100% of the 4 year olds had 3 injections, 66% of the 5 year olds had 3 injections, 33% of the 7 year olds had 3 injections, and 14% of 9 year olds had 2 injections. The rest of the subjects only had one injection. In addition, number of prior venipunctures, whether or not restraints were used, and types of comfort holds were recorded for comparison purposes.

Procedure

The researcher conducted the study inside the immunology room of the Rap Clinic. Unlike other doctor offices, the patients do not receive their immunology shots in the same room as they see their primary physician. Instead, the Rap Clinic has different rooms where different procedures occur. For example, there are rooms specifically for physicals, blood draws, and for immunology injections. There are no appointments for the immunology injections made prior to the child’s visit with the physician; therefore, there is no way to predict who will receive injections on a daily basis. Rather, nursing is notified on an hourly basis as to who will receive injections.
While waiting for patients to meet the criteria for the study, the researcher waited inside the immunology room and remained as inconspicuous as possible. Once nursing received the patient’s forms for their immunology injection, they would then notify the researcher on whether or not the patient met the criteria for the project. When the patient met the criteria, the researcher then informed nursing whether or not the patient was a subject for the control group or experimental group.

When the experimental children ages 3½ to 10 years entered the room, the researcher would welcome the patient. The researcher would introduce herself by name and as a music therapy intern and then asked the child for his or her name. The researcher proceeded by asking the patient whether or not they knew what a kazoo was and how to make it work. The researcher would model different ways the kazoo could be played, most of which were obviously silly ways. The child played the role of telling the researcher if she was doing it right or wrong. This was done in order to increase the child’s sense of control and to provide an unexpected comic relief. If the child could not figure out the correct way, the researcher would then proceed to explain how the kazoo was played. First, the researcher would instruct the child to take a deep breath and then exhale while making an “O” sound. Once the child successfully demonstrated the sound the therapist would instruct the child to continue making that sound while bringing the kazoo to the mouth.

Following the brief kazoo lesson, the child would be positioned for the injection. With children ages 2 to 6 years, the parent facilitated the pain management process through comfort holds. The researcher kept three criteria in mind when she positioned herself for the procedure. (1) She would position her body in a fashion that would be a
focal point to facilitate distraction. (2) She made sure that eye contact could be maintained with the subject. (3) She made sure that her body position supported the security that the patient feels with the parent’s comfort hold.

After the subject was ready for the injection, the researcher began singing the song “I’ve Been Working on the Railroad” with a Q-chord accompaniment set on EZ play with the sound effect of vibraphone. The researcher integrated into the lyrics of the song the child’s name, how s/he should play the kazoo (loud vs. soft), and incorporated holds at the end of each phrase to encourage and facilitate the child to take deep breaths.

For children ages 2 and 3 years the researcher sang the “Barney Song” while tapping on a shinny tambourine. Most toddlers do not have the cognitive ability to learn how to hold and play a new object like a kazoo in less than a minute. Therefore, this approach was more age-appropriate because the familiar “Barney Song” was comforting, and the reflection in the tambourine was intriguing. The tambourine was positioned to distract the child from looking at the location of the injection and to encourage the child to look at his eyes in the reflection of the tambourine or to look into the researcher’s eyes. The song was sung initially to match the child’s behavior and would progress to a relaxing tempo. If the child would cry, the researcher would hold the end of phrases to match the child’s breathing pattern. Through synchronizing breathing and vocal patterns between the researcher and subject, a simplified form of entertainment became a nonverbal relaxation method that was comforting to the child.

The control group did not receive any music. The researcher sat in a chair located in the corner of the room. This was the most inconspicuous location for the researcher to sit. During the procedure, the researcher sat quietly and only spoke if someone spoke to
Once the control and experimental subjects concluded their procedure, the researcher asked the patient to rate their pain based on the AP&P II pediatric pain assessment scale. The researcher would explain to the subject that each face is for a person who feels happy because he has no pain, or sad because he has some or a lot of pain. If #1 represents no hurt with smiles and #5 represents a lot of hurt with crying, the patient was asked which face felt like him or her. Once the subject completed the pain assessment and exited the room, the researcher and nurse filled out separate behavioral assessment forms that would later be reviewed for future analysis.

**Behavioral Observations**

Each subject was evaluated using a behavioral assessment form based on Dr. Schuster dialysis rating form (Standley, 1986). For reliability purposes, both the nurse and researcher filled out separate behavioral assessment forms. The layout of the form asks a series of nine questions that determine the behavior of the subject prior to the onset of the treatment, at the onset of treatment, during the treatment, at the conclusion of the treatment, and after the conclusion of the treatment. In addition to determining their behavior during the treatment, their interactions with nursing, music therapy, and parent were also assessed. Finally, their overall anxiety level was estimated on a scale that rated from 1-5. One represented behaviors that were extremely calmed, relaxed, and compliant. Two represented behaviors that were occasionally hesitant to follow directions. Three represented behaviors that were cooperative but complained. Four represented behaviors that were very anxious and would frequently complain. Five
represented behaviors that were extremely anxious and complained constantly despite the attention of nursing.

The final statistical comparison reflected an average of both data entry forms, which computed the average of each individual.

**Results**

This study attempted to determine whether the addition of music therapy was more effective in facilitating the reduction of pediatric pain perception and distress during injections. A comprehensive analysis included a statistical comparison of the observation data gathered from the researcher and nurse, which were to have a reliability agreement of 82 percent.

The statistical comparison implies that the five to ten-year-old pediatric patients tend to rate their pain generally lower with music than without. The exceptions were the nine-year-old patients that represent 20 percent of the total subjects. Two and three-year-olds did not apply to this rating scale due to cognitive ability. The four-year-old subjects had no difference. Results implied that with the music the two, four, six, seven, eight, and ten-year-olds demonstrated less behavioral stress during the injection. The three and ten-year-olds showed no changes and five-year-olds that represent 9 percent of the total subjects, demonstrated to have more distress with the music. The addition of music increased positive interactions with parents for two, three, and six-year-olds. No changes were found with the other ages.
Results implied that with music the interaction with nursing was more relaxing for the pediatric patients ages two, three, four, six, seven, eight, and nine. No changes were found with five and ten-year-olds.

The data indicated that the following percent of children needed to be restrained during the injection: 100 percent of two-year-olds, 75 percent of three-year-olds, 80 percent of four-year-olds, 33 percent of five-year-olds, 25 percent of six-year-olds.

Comfort holds were recorded as being utilized 100 percent for two-year-olds, 33 percent for three-year-olds, 60 percent for four-year-olds, 66 percent for five-year-olds, 25 percent for six-year-olds, 33 percent for seven-year-olds. The following were the positions used for each age group: Two, three, and four-year-olds were settled in a straddling position on the parent’s lap, five and six-year-olds were seated on the doctor’s table while their parents gave them a hug, and seven year-olds held their parent’s hand.

The following graphs are statistical comparisons of subjects according to age. The first diagram is a Pediatric Patient Pain Rating Scale that compares all of the age groups perception of pain. The graphs following the Pediatric Pain Rating succeed according to age group. Each graph depicts the results of the data gathered on subjects’ behavior and interactions with nursing, parents, and researcher. Each comparison analysis outlines the experimental group in blue and the control group in maroon.
**Discussion**

The addition of a music therapy technique that has the potential to be generalized appears to be effective in facilitating the reduction of pediatric distress during immunology injections. The analysis of the statistical comparison of each age group implied that children who received music were recorded as having less behavioral distress during their injections, which therefore promoted a safer procedure. A surprising result was how greatly the four, six and eight-year-olds benefited from the music. Interaction with nursing proved to be more positive with the addition of music as well. The only age groups that did not show any changes were the five and ten-year-olds, which was astonishing do to the fact that no age group demonstrated greater distress with the music.

In analyzing the results of the distress of two and three-year-olds, an unexpected result occurred. There was a decrease in overall behavioral distress with the addition of music but the overall level of distress was higher. The greatest difference for the experimental two and three-year-olds was the increase in positive interactions with the parents, which suggests that the music was supportive to the parents that were facilitating the process of pain management with comfort holds.

The statistical comparison of the Pediatric Patient Pain Rating reveals significant differences between children rating their pain higher than the behavior they exhibit. This could suggest that the theory of adults’ underestimate the pain of children could partially be due to the fact that they do not exhibit a behavior that may be believed as behavior of pain. This proves that there needs to be more research in learning about how children
express their pain so that the medical community does not continue to underestimate children’s perception of pain.

The data also found some variables that may have affected the study. Two of the experimental subjects and one of the control subjects received venipunctures prior to entering the room for their immunology injection. Their behavioral distress at the start of a procedure was rated higher than the children who had not had venipunctures, and all of these subjects needed to be restrained during the procedure. The data appeared to suggest that the subject’s initial level of distress predicted their overall level of anxiety during the procedure. Their heightened anticipatory anxiety could have prevented them from engaging in the distraction tactics of the pain management interventions of music therapy, medical staff, and parents.

Another variable was the amount of immunizations that the children received. Often, children could be distracted for the first two shots, but by the third shot they could no longer be distracted with music. The data showed that 34 percent of the subjects received two or more shots, and of those subjects one in every four was restrained.

Much more research is needed to fully understand the effects of live music on the behavior of children. Factors that may enhance this study could be taking a salivary immunoglobulin A (IgA) sample of the subjects before and after the immunology procedure. This could determine whether or not there were any significant decreases in stress; therefore the data could give a suggestion to the type of mood each subject exhibited during the procedure. Another element that would benefit the study would be determining how long the child anticipated the shot. During the busy periods of the clinic, children would sometimes have to wait forty-five minutes between visiting their
physician and waiting for their injection. This extended length of time could increase anticipatory anxiety thus affecting the behavioral distress level of the child during the immunology procedure. Finally, including an additional pain rating for each subject a half an hour after the procedure could provide more knowledge on the children’s perception of pain. Differences in rating could determine how the child remembers the event; thus affecting how the child may behave during the next injection.

In determining whether or not the addition of music therapy to the pain management strategies already in place is effective in the reducing the behavioral distress in pediatric patients receiving injections, the answer appears to be yes.

**Bibliography**


