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The Role of Live Music and Singing as a Stress-Reducing Modality in the Neonatal Intensive Care Unit Environment

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Abstract

Among the developmentally supportive care modalities that have been tested in the treatment of preterm infants, music interventions have been tested quite intensively. This article reports on the environmental, cultural, and philosophical considerations of a research program that studied the effects of live music, wordless singing, and rhythm upon neonates in a Middle Eastern NICU hospital unit. The cultural setting and dynamics of the NICU created a unique challenge which involved the discovery of music as an intervention that effectively enhanced communication within a culturally divergent population. At the same time, music decreased stress and increased a sense of humanity in the intensive care unit setting.

Keywords

arts medicine, maternal singing, NICU music therapy, wordless singing, live healing music, frame drum

In recent years, developmental care approaches that use a range of nursing interventions aiming to decrease the stress of preterm neonates in neonatal intensive care units (NICUs) have been developed (Symington & Pinelli, 2006). These interventions are designed to allow optimal neurobehavioral development of the infant and by that to improve neurodevelopment outcomes. A variety of approaches have been used: control of environmental stressors known to cause physiological and behavioral disorganization, for example, light and sound; scheduling of caregiving; integration of parents; specific supportive behavioral techniques, such as nonnutritive sucking, opportunities for grasping, and swaddling; and general motor containment, such as kangaroo care (Symington & Pinelli, 2006).

Among the different developmentally supportive care modalities that have been tested in the treatment of preterm infants, music interventions have been studied (Arnon et al., 2006; Kaminski, 1996). Music intervention in the NICU serves several purposes. It can enhance physiological stability, behavioral organization, and sensory system development and mask ambient noise. Music can serve as a catalyst for family-centered care (Shoemark & Dearn, 2008). In singing to their child, parents might feel more involved in their infant's well-being, which can enhance bonding (O'Gorman, 2006). A review of procedures in music therapy implementation was developed based on research conducted over 15 years in several clinical applications of research protocols in the United States and Australia (Standley, 2002). Research in NICU music therapy has shown important benefits for both infants and caregivers (Nocker-Ribaupierre, 2004) and with infants who have complex physiological circumstances and medical needs (Shoemark, 2004). Music therapy offers the capacity to contribute in vital ways across the spectrum of experience, and research in NICU music therapy has shown consistent benefit for infants, parents, and caregivers in this environment (Stewart, 2009).

In a study published in 2006, Arnon et al. demonstrated that 30 minutes of live music played in the NICU to stable preterm infants at 32 weeks postmenstrual age and older resulted in an improvement of physiological and behavioral short-term stress parameters. Live music application was associated with a significant decrease in heart rate 30 minutes after therapy ended. Notably, responses to a questionnaire indicated that live music was considered by parents to be beneficial. As for medical personnel, music therapy was noted to be beneficial for the preterm infant, but the effect was not considered necessarily to be as significant as medical treatment.

This article reports on the cultural and philosophical underpinnings of the protocol used in this study, as they have not been previously reported in the Western literature and can make an important contribution to cross-cultural understanding and open new possibilities for the creation and compositional elements implemented in NICU music therapy.

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Cultural Considerations

In a study examining cultural affects upon listening and infant-directed singing, Trehub et al. (1997) showed that there are both universal characteristics to infant-directed singing and culturally specific components to a singer's performance style. In the Arnon et al. (2006) study, a wordless, rhythmic, constant, repetitive, soothing lullaby was sung by a female voice, with an Eastern frame drum as an accompanying instrument (Gilad, 2002).

Being a multicultural society, the infants mainly belong to Jewish and Arab families with different cultural and musical backgrounds. The hospital serves a population that is close to 50% Jewish and 50% Arab. Among the Jewish population, many of the mothers are from Eastern cultures themselves. The Eastern approach to music and the Western approach are very different. In the West, harmony is constructed by layering varying tones of different ratios or intervals, such as 1-3-5. This causes a pleasant sensation to the Western ear. In the East, there is a different aesthetic. The music system of the Eastern world is far too complex to discuss in this article. What is common to this idiom is that singing and musical instruments are played in unison. The repertoire is based largely on improvisation. Aesthetic harmony comes from the slight nuance that the musician brings to the musical expression. The musical tradition has been taught orally and aurally since ancient times.

Drawing on the Near East traditions offers a unique benefit of bringing light to the ancient and oral traditions of the area, which draw upon connection to instinct and innate ability rather than academic study. For this reason, a blend of Eastern and Western wordless melody that could apply to all was chosen.

Archaeomusicological studies from the ancient Near East have produced an abundance of artifacts depicting female musicians playing frame drums and harps (Dunbrill, 2005). For this reason, the instruments used in this study were frame drum and harp to accompany the singing.

Music Intervention Overview

The practice of singing to infants and many details of song form and style are rooted in ancient traditions that have survived industrialization and urbanization (Sekeles, 1996). The hospital where the current study took place serves a multicultural population, including many whose music traditions are rooted in the ancient cultures of the Mediterranean and Middle East. A wordless healing music modality was developed by one of the authors (Gilad), combining an Eastern and Western approach to music. Necessity can be a great mother of invention. The wordless music modality was an innovation further inspired by the presence of the multicultural, multilingual population. Ancient healing and transformational music is based on the premise that wordless singing embodies inherent healing qualities.

The significance of singing, as Loewy (2002) points out, has been recognized by civilizations since the beginning of human history. Wordless singing holds many advantages: It utilizes the nutritive essence of sound at its fundamental level. It is believed to bypass the intellect, allowing the brain to relax. It can also bypass the constraints of someone not understanding the words being sung. Wordless singing has been implemented in a music therapy developmental framework where crying comfort sounds precede phonemes and tonal vocal holding leading to phonemic musical play enhances reciprocal vocalization between infants and caregivers (Loewy, 1995). Researching the effects of wordless singing in this context served to highlight the advantages of implementing it in an NICU setting.

Maternal singing is more effective than speaking in maintaining infant attention, and it also reduces infant arousal (Trehub & Nakata, 2001). The success of singing in regulating mood and arousal may account for its prevalence in child care settings across cultures and historical periods.

Considerations in Preparing the Program

There were a number of aspects to take into consideration in preparing the program for the NICU music project. These issues, which are outlined below, are not often examined in the music therapy or music medicine literature. They are worth considering, especially in instances when the NICU serves a multicultural population. The following elements were examined carefully by the team prior to each and every intervention.

1. Language. Determining in which language to sing was our first consideration. The hospital serves a multicultural society, with infants belonging to Jewish and Arab families with different cultural and musical backgrounds. In addition, there are families from Russia and Ethiopia whose first languages are Russian and Amharic. It became important to approach the music intervention with a blend of Eastern and Western music elements that would serve a wide range of the population. Tension is exacerbated in a hospital environment where privacy is minimal, and caretakers may experience helplessness and lack of control. Lack of a common language in which to communicate can increase anxiety.

The wordless approach allowed for the singer to more easily integrate a mixed group of multicultural, multilingual parents into caregiving through showing them how to use their own voices to sing to their babies even as music intervention was being given to the entire NICU. This instruction was given if the mother expressed a willingness and interest in singing to her baby. Instruction was given in Hebrew. If the mother was a speaker of Arabic, Amharic, or Russian, a physical demonstration was used. This support was given individually to the mother on a case-by-case basis. If she did not ask, the musicians would play music for the entire group, and the mother would respond intuitively as she deemed appropriate.

2. Monitoring equipment. We considered how to proceed when the monitoring equipment produced sounds: Should the music stop or continue? Since the equipment could be signaling

a number of possible situations, it was not clear whether continuing to play the underlying musical rhythm on the frame drum would cause distress to the infant. This was checked with the staff and determined with the medical team on a case-by-case basis.

3. Sociopolitical tension. The Middle East crisis was under way when the project began. Bombs had exploded in a nearby neighborhood, which contributed added tension to the already stressed environment. Many of the parents hail from remote rural villages and are not used to being in a culture where they do not understand the language, nor are they used to having to cope in a noisy modern hospital with multiple environmental stressors.

Structured musical improvisation is a common experience for this population (Eliyahu & Shvariov, 1997), and therefore it was used as a basis for the wordless music, which masked the sound through integration, thereby reducing the tension of staff and parents. Turry (2002), who worked intricately with those traumatized by the events of 9/11, notes that improvising is intrinsically linked to a sense of trust in the unknown. He explains how by placing faith in the power of music to reach the listener, the improvising therapist is able to engage intuitive processes with a sense of creative freedom in the here and now. The current healing music approach was founded upon deep listening and responding in the moment to what was occurring in the unit.

4. Noise. Infants in the NICU are often subjected to noise levels, which causes concern, but the special properties of music can provide benefits and a solution to the noise (Stewart & Schneider, 2000). Premature infants in the NICU are often exposed to continuous loud noise despite research documenting the presence and damaging effects of noise on the preterm infant's development. The American Academy of Pediatrics (AAP) Committee of Environmental Health (2000) recognizes that exposure to excessive noise may damage fetuses and newborns (Evans & Philbin, 2000). Excessive auditory stimulation creates negative physiologic responses such as apnea and fluctuations in heart rate, blood pressure, and oxygen saturation. Preterm infants exposed to prolonged excessive noise are also at increased risk for hearing loss, abnormal brain and sensory development, and speech and language problems. Reducing noise levels in the NICU can improve the physiologic stability of sick neonates and therefore enlarge the potential for infant brain development. Discussed in relationship to a study on the effect of live music in neonatal ward, Arnon et al. (2006) refer to a meta-analysis of the efficacy of music therapy for preterm infants that showed music to have a significant and positive impact on preterm infants. Live singing and multimodal stimulation was shown to shorten hospital stays and to increase tolerance for other stimulation.

Live music was performed at a distance of 1 to 2 meters from the infant's bed unit and played at a mean volume of 60 dB (Arnon et al., 2006). This volume was louder than the unit background noise, but it was pleasant for both staff and parents, and infants did not show signs of hyperresponsiveness. As recommended by the AAP (2000), background noise measured near the infant's ear did not exceed 45dB.

The infants were introduced to music for the first time in their lives and heard the same music only twice; therefore, no habituation effect confounded the study results.

The Music Model

Given the high potential for interruptions and distractions in the hospital, five elements of the healing music model were used. These elements were inspired by the traditional use of music in the Eastern world, handed down orally from generation to generation since ancient times.

1. Silence and Focus

Reducing noise levels and creating a field of concentration and the ability for the music to be heard. The ancient Rabbinic scholar and physician Maimonides (d. 1204) wrote extensively on the healing use of music. In his time, the Western approach to music had not yet been developed. Shiloach (2000) expounded upon the detailed regimen that Maimonedes prescribed in the Epistles to al-Afdal (d. 1225). In his medical writings, he prescribes singing and music as a means of inducing sleep. The performance should be given by a singer to the accompaniment of a stringed instrument. The singer should decrease gradually the volume of his voice and attenuate the sound of the strings so that it becomes mere whispering: Both should cease completely when the patient falls asleep (Shiloach, 2000). The singer and harp player would gradually reduce the volume of their playing until the music reached complete silence.

Focusing and connecting to silence. Recommendations for reducing noise in the ICU include implementing a quiet hour, educating staff to raise awareness, and encouraging staff to limit conversation near infants (AAP, 2000). The door was closed prior to beginning the music intervention. Conscious focus on silence was implemented. This allowed for increased quiet and focus in the unit. The musicians would wait for caretakers and staff to settle down before beginning. The regimen included not speaking to the staff, parents, or infants prior to beginning of the music.

2. Long Single Note

In Eastern music, a long single note is sung as a drone, which allows time for the listener to gradually become accustomed to the fundamental tone of the music. The drone is cyclical, similar to the breath. Shenfield, Trehub, and Nakata (2002) note that maternal singing reduces infant arousal. Singing a drone is relaxing. One note is sung to one breath. It can increase a sense of safety and well-being and remind the infant of fundamental sounds heard from within the womb.

3. Heartbeat

The ostinato rhythm provided constancy. When the mechanical equipment would go off, if the singer was singing with the frame drum as accompaniment, she would stop the rhythm and begin to improvise, using the beeping signals as a guide for note, pitch, and rhythm. The approach adopted was to adapt the music and the rhythm to the pulse of the machine. Loewy and her colleagues have noted that live music should be adapted and shifted in the moment or entrained to match the breathing rate of an infant's physiological response (Loewy, Hallan, Friedman, & Martinez, 2005). The singer may sing a fifth, either below or above the fundamental note of the monitor alarm, entraining with the baby (Loewy, 2004). Although Eastern music is not built on harmonies—the fifth note of a scale is an element of musical development—a droned fifth note was sung, one breath to one note. The fifth note is a dominant musical element shared by Eastern and Western cultures (Eliyahu & Shvariov, 1998). It would be considered an aesthetically pleasing sound for both the Jewish and Arab mothers. Many times, the result was that the equipment would stop making a sound. At that point, the musicians would stop and allow for the silence to penetrate the environment.

4. Rhythm

In Eastern music, rhythm is metro rhythmic, meaning it is inseparable from the melody.

> In Arabic, it is called "Usul," meaning "root," "laws" and "implementation," "effective behavior." The "usul" is based upon low tones, called "deaf notes" and bright tones called "ringing notes." Up until the nineteenth century (meaning until the time when musical notation began to spread), rhythms were taught and transposed by onomatopoeic imitation or suggestion of the source of the sound they are describing. "Doum (or boum)" is the lower sound and "Tak (or bak)" is the higher. (Eliyahu & Shvariov, 1998, p. 7; translated from Hebrew)

The rhythm is endemically woven into the main fabric of the music, as if it were a melodic instrument (Eliyahu & Shvariov, 1998). Rhythm is taught viscerally through wordless singing of the rhythm while physically tapping it upon the body. In the 16th century, the famous blind doctor of the Eastern world, Da'ud al-Antaki, introduced medical applications for rhythmic modes, providing them with appellations that suggested their major affects (Shiloach, 2000). The 10/8 eastern rhythm of Semai has a certain tempo and is used to connect Easterners to sadness. Sadness allows the listener to have a cathartic experience, and this is considered joyful. For young Arab mothers from rural villages, this particular rhythm was particularly useful for creating connection and allowed for support in their ability to bond with their babies. The music, in this case, was used for psychological purposes.

5. Melody

Given that there are so many interruptions in a hospital ward, with many opportunities for distraction, the last element of melody, sung wordlessly, with the other four elements can bypass the intellect, connecting the essence or source of the sound. Special healing music melodies based upon earlier ritual were performed in hospitals in ancient times. Musical performances were often given at the Mansuri Hospital in Cairo; one of the designated expenditures was for troupes of musicians to come each day and play for the patients. Patients suffering from insomnia were placed in a separate hall; they listened to harmonious music (Shiloach, 1993).

Conclusion

In a previous study, Arnon et al. (2006) showed that live music is beneficial in relieving stress reaction in the NICU. There was a significant reduction in heart rate, increased blood oxygen saturation, and more relaxing behavior with live singing compared to no music or recorded lullabies. In the current study, analyzing the principles of wordless singing in developing an efficient live music approach applicable to the NICU environment, we found the important elements to be (a) reducing noise levels and creating a field of concentration and the ability for the music to be heard; (b) focusing and connecting to silence, using mainly long single notes; (c) using the monitor beeps as a guide for note, pitch, and rhythm; (d) adjusting the rhythm to the infant's cultural background; (e) using female voice accompanied by a musical instrument (i.e., harp); and (f) playing a constant rhythm on a frame drum from the Eastern world.

Furthermore, drawing upon ancient music elements and using instruments common to both Eastern and Western approaches to music allowed for mothers from Eastern and Western cultures to be able to connect with it. Wordless singing allowed for the music to be accessible, as there were no words to provide for nonunderstanding of the language. It would be helpful to have more research conducted on the use of wordless voice. Research investigating the effect of specific rhythmic applications could be helpful in instituting and revitalizing the inherent power of sound into the modern-day hospital environment. Since there is little research that has been conducted on the Eastern elements of music, it would be helpful to research the physical implications of a long single note, sung or played on a tradition instrument from the Eastern world, traditionally used for this purpose. Showing health care professionals and parents how to apply voice and rhythm with touch in bonding with their infants could help to increase parent interaction in the NICU as well as increase the human aspect of the hospital environment.

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Bios

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