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Music and Sound Modalities to Enhance Pain Management

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Abstract

Music and sound vibration therapies are gaining popularity in the human health and veterinary fields. The vast majority of work being described in the medical literature is related to the mood-modulating effects of music therapy; however, a recent trend in acoustic research involves pain management. Clinical studies in humans have shown that music-induced analgesia is effective, with or without concurrent relaxation. Nervous system diagnostics are revealing the mechanisms by which sound affects the pain network and how it can be used to return this network to a more normal state. Given that music and sound therapies are cost-effective and safe and can be administered by pet owners, using them for acute and chronic pain patients offers an additional and valuable approach to pain management.

Introduction

Music and sound vibration therapies are gaining popularity in the human health and veterinary fields. The vast majority of work being described in the medical literature is related to music therapy. Many of these studies focus on mental health, specifically looking at ways to reduce anxiety.

Research in various animal species also shows the antianxiety benefits of music therapy. Classical music decreased stress behaviors in kenneled dogs better than heavy metal, pop, and conversation (1, 2). Heart rate variability, a measure of stress, also improved with classical music in kenneled dogs. This change was still measurable after 9 days of music therapy, meaning the dogs did not habituate to the music (3). Other studies, however, suggest that habituation may occur and suggest using a variety of music (4, 5). Gorillas showed a tendency toward relaxation and a reduction in stress behaviors with rainforest sounds and classical music, and elephants had a significant decrease in stereotypic behaviors with classical music (6, 7). Laboratory rodents also showed a decrease in anxiety behaviors with music intervention (8).

Similar data are found in human studies. Clients who listened to music while waiting in veterinary offices had higher visit satisfaction (9). In a study of musicians, music was shown to improve mood and help with emotional conflicts (10). It has also been useful for people with posttraumatic stress disorder of varying etiologies (11, 12). And in a study of people who had suffered myocardial infarction, the group that listened to music for 30 minutes daily had a lower incidence of heart failure, new myocardial infarction and bypass surgery, and mortality. The authors theorized that the results were due to the cardiovascular system's response to relaxation (a).

A recent trend in sound and music research involves pain management. The economic burden of pain in American society is estimated at more than $500 billion annually (13). Managing veterinary patients can be challenging because we are limited in the number and type of preparations for our patients, especially cats. The opioid crisis has also intensified the focus on managing both acute and chronic pain. Medications continue to be redefined as controlled substances, which also impacts veterinary medicine. Gabapentin, a widely used medication for pain in animals, is now under consideration for controlled status. Music therapy and sound healing may be useful and needed adjuvants in pain treatment strategies.

Music Versus Sound

Most music therapies use the principles of psychoacoustics, which is the discipline that studies the perception of sound in humans as well as how it affects brain function. It has been shown that slow tempos, lower tones, and minimal complexity calm the nervous system in people and animals (14). Higher tempos with more complex instrumentation have been shown to improve focus and learning.

Psychoacoustics also includes a person's psychological preferences because music has a strong influence on our emotions (15). Animals may show musical preferences as well (16). One study showed that dogs were calmed with a variety of music, including soft rock and reggae (5).

Although sound (sonic) healing modalities may influence the nervous system, they primarily focus on the effects of oscillating sound on the body. Mammals have mechanoreceptors in muscles, periosteum, skin, and subcutaneous tissues that respond to vibration (17). Novel research supports this direct effect of sound on the body. A study of cultured cells found that exposing them to sounds triggered a suppressive effect on ultrasound-sensitive and mechanosensitive genes (18). Sonic modalities may be used directly on the body, as with weighted tuning forks, or near the body, as is experienced with nature sounds, human sound, musical instruments, crystal and metal bowls, drums, rattles, and unweighted tuning forks. Therapeutic interventions used off the body are often referred to as "sound baths." These interventions not only affect the physical body but also clear and harmonize the biofield, which is the electromagnetic field within and emanating from humans, animals, and plants (19, 20).

Some music researchers also use direct sonic concepts by influencing the nervous system in unique ways. Playing music through headphones that encompass the entire ear allows sound oscillations to stimulate the vagus nerve by physically touching the tragus, an innervation point for the auricular branch of the vagus nerve (21). The tragus is also an acupuncture/acupressure point for the vagus. Sympathovagal imbalance is hypothesized to increase stress and contribute to stress-related disorders. Stimulating the vagus is believed to repair this imbalance by increasing parasympathetic activity of the autonomic nervous system, thereby decreasing sympathetic activity Low-level electrical stimulation of the tragus has been shown to improve cardiovascular parameters in humans (22). Although it is unlikely that veterinary patients will tolerate headphones, this work does open the door to using the tragus to decrease stress, which may assist in pain management.

Pain Management

Reducing anxiety through music and sound therapy can also assist in the management of pain. Many studies have shown that calming results in decreased perception of pain in humans. Patients listening to music while undergoing lithotripsy had a significant decrease in pain and anxiety and were more likely to repeat the procedure (23). In a meta-analysis, music was found to decrease self-reported chronic pain and comorbidities, such as depression (24). Pain and its associated distress were reduced in cancer patients who listened to music while hospitalized (25). These studies also suggest the importance of psychoacoustics when choosing therapeutic music. Each study found that culturally appropriate music or music the subjects enjoyed produced a stronger effect than music chosen by researchers.

The findings that regulating mood may have an effect on pain are not surprising, as neurologic pathways modulating pain share some of the same pathways that govern emotional experiences. In addition, neurotransmitters important for mood, such as serotonin and dopamine, are released with enjoyable music (26). It would make sense that any modality that reduces anxiety may also reduce pain, and vice versa.

But can sound healing and music therapy reduce pain independent of their antianxiety effects, or is a decrease in pain strictly a result of relaxation and a reduction in anxiety? Although it is difficult to know for sure, there is evidence to suggest that music and sound may also exclusively modulate pain. This is termed *music-induced analgesia*. A cold-induced pain study in which subjects listened to music, news, or silence found that the music group had lower pain perception and higher pain tolerance than either the news or silence group. The degree of difference was higher in subjects who had normal anxiety surrounding pain compared to the group with heightened general anxiety, leading to the conclusion that pain relief was not solely based on reducing anxiety. In fact, researchers concluded that extreme anxiety may override music's ability to decrease pain (27).

Nervous system diagnostics are useful in understanding the mechanisms of music-induced analgesia. In a study in which participants were subjected to laser-generated pain, magnetoencephalography data showed that participants listening to music were able to shift their attention away from the pain. The areas of brain wave activity that were mapped were not related to mood (28). A functional MRI (fMRI) study revealed changes in the descending pain pathways in subjects listening to music while experiencing heat-induced pain. Among the pathways, activity

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was observed in the dorsal horn of the spinal cord, which is a key area for the modulation of pain. The researchers hypothesized that pleasurable music evoked the release of opioids, which then influenced the pain-modulating pathways (29).

Changes were also found on fMRI in patients with fibromyalgia. It has been shown that people with fibromyalgia have a connectivity imbalance within the nervous system pain network, leading to chronic pain, even at rest (30). Listening to classical music changed the abnormal network to a more normal state and reduced the participants' pain scores (31, 32).

Sound modalities, when used on the body, have also been shown to create analgesia. Weighted tuning forks placed on the spine can relax tissues and decrease pain in domestic animals (17). Similar effects have been found in people. Another sonic modality, vibroacoustic therapy, is increasing in popularity. This sonic treatment delivers sound oscillations through beds, chairs, or footpads (20). The author has not seen any of these products specifically designed for animals as of yet; however, portable music therapy devices are available for animals, which may be helpful for travel or veterinary visits (33–35).

Conclusion

Several studies have shown that music can be calming to many species. Because anxiety can affect pain responses, it would make sense that using calming modalities may benefit pain control in veterinary patients. It seems reasonable to add music and sonic therapies to treatment protocols for both anxiety and pain. For example, if a patient is having an agitated recovery from anesthesia, calming music may be beneficial. Once any patient recovering from anesthesia is stable, adding calming music may reduce pain. Initiating calming music too soon following anesthesia could keep the nervous system depressed, creating a longer recovery.

Research in humans suggests that music and other sound interventions can be helpful for pain control, although studies are lacking in animals. But given the rigorous data in humans and the similarity of nervous system function, sound and music therapies may also benefit animals with chronic pain. Having owners play calming music at home is a very cost-effective adjunct to pain medications. It may also help reduce anxiety created by strict rest after orthopedic procedures. It is important to explain to clients, however, that less is more. Animals are quite sound sensitive, and the most common mistake seen with music therapy is that the volume is too loud. This can result in a stimulating effect on the nervous system.

Although fibromyalgia has not been documented in animals, acoustic therapies may benefit unusual pain syndromes, such as feline interstitial cystitis or neurologic pain found in Cavalier King Charles Spaniels. Music therapy may remodulate the nervous system in feline hyperesthesia syndrome, in addition to quieting the pain. The author has experience using tuning forks along the spine of Cavaliers to reduce neck pain and scratching at the ears. Adding sonic modalities to other chronic pain conditions, such as degenerative arthritis and disc disease, may improve quality of life for these animals.

Sound therapies are easily learned, making them ideal for clients to use at home. Sonopuncture uses tuning forks at acupuncture points, so clinicians could send clients home with sonopuncture instructions to follow in between acupuncture visits. Similarly, in-home usage of tuning forks, sound bowls, and music therapy may also be beneficial adjuncts to other modalities, such as energy medicine and chiropractic and rehabilitation therapies. Given that music and sound therapies are cost-effective and safe, using them for patients with acute and chronic pain may offer an additional and valuable approach to pain management.

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Endnote

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