Improvisational music therapy approaches to coma arousal

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Abstract

The use of music therapy in coma arousal has become increasingly important as music therapy interventions are refined. This article reviews various music therapy methods for coma arousal, in particular, the application of improvisational music therapy for patients in altered states of consciousness. Clinical vignettes illustrate the goals of improvisational music therapy including: internal integration of physiological body rhythms, sensory stimulation and facilitation of communicative contact through music. The question of whether sensory stimulation is beneficial for people in coma is currently being debated in the medical literature. It is therefore of interest to music therapists to be aware of the prominent arguments in this debate and to have an understanding of how music therapy techniques can be employed to facilitate arousal and awareness.

Coma arousal interventions involve various forms of intensive sensory stimulation programs designed to accelerate recovery from coma (Pierce, Lyle, Quine, Evans, Morris & Fearnside, 1990), however the inclusion of music therapy in programs for people in a comatose state, is not commonly reported. The issue of sensory stimulation, and its possible benefits and contraindications is currently under debate in the medical literature (Pierce, et al, 1990; Wilson & McMillan, 1993; Wilson, Powell, Elliot & Thwaites, 1993; Wilson, Powell, Brock & Thwaites, 1996; Wood, 1991; Wood, Winkowski, Miller, Tierney & Goldman, 1992; Wood, Winkowski & Miller, 1993). Music therapists working in this area therefore need to be aware of the issues in this debate, and to have an understanding of how music therapy techniques can be used to increase awareness in patients who are in coma. Music therapy can offer an alternate approach to traditional, medically based coma arousal procedures. The first part of this article highlights the various models of coma arousal presented in the medical literature, and the controversy surrounding sensory stimulation procedures. The second part discusses music therapy interventions, in particular, improvisational music therapy, and the philosophies and

theories that inform this approach. Clinical vignettes are included to illustrate the implementation of improvisational music therapy with four comatose patients.

Levels of consciousness range along a continuum from total loss of consciousness (coma), to various stages of impaired consciousness (posttraumatic amnesia and vegetative state), to full consciousness (Baker, 1999; Bates, 1993). To accurately diagnose levels of consciousness is difficult due to minimal and fluctuating responses to external stimulation. Plum and Posner (1980) define coma as "the total absence of awareness of self and environment even when...externally stimulated" (p. 1), that is, the patient does not open their eyes, follow commands or speak. Patients who exhibit periods of wakefulness, and perhaps primitive postural and reflex movements of limbs are no longer in coma but a 'vegetative state' (Sazbon & Groswasser, 1991). Jennett and Plum (1972) describe this state as wakefulness without awareness. Aldridge (1996a) however believes that there is a continuing awareness, and refers to coma as a state of unconsciousness where a person's internal body rhythms, such as cardiovascular, cortical and somatic activities, are severely disorganised. He hypothesises that the rhythmic coordination of the cardiovascular system with cortical rhythmic firings is important for cognition.

Assessment tools devised to measure levels of consciousness and responsiveness include the Glascow Coma Scale, the Rancho Los Amigos Scale (Claeys, Canipe, Dalloul-Rampersad & Koller, 1989), the Levels of Cognitive Functioning Scale (Boyle, 1989) and the Rappaport Scale (Rappaport, Dougherty & Kelting, 1992). 'Coma' and 'vegetative state' are terms that describe different stages of consciousness and thus are not synonymous, however, patients in either stage exist in states of extreme physiological and cortical disorganisation. Hence music therapy methods and goals used to achieve internal integration and awareness may be applicable to both.

It is desirable to awaken patients from coma as soon as possible for three reasons: medical, humanitarian and economic. First, from the medical viewpoint, the depth and duration of coma indicate the expected degree of recovery (Ponsford et al., 1995; Rosenthal, Griffith, Bond & Miller, 1990; Teasdale & Jennett, 1976). When a patient awakens from coma he/she is in a stage called posttraumatic amnesia (PTA) which is characterised by poor orientation, agitation, and an inability to learn (Baker, 1999). The length of PTA, which includes the period of coma, is correlated with severity of head injury, so accelerating recovery from coma aims to improve patient's subsequent prospects for long term rehabilitation (Lucia, 1987; Pierce et al., 1990). Second, early awakening from coma may decrease anxiety levels for both the family and the patient, and improve their quality of life. Finally, from an economic viewpoint, people in coma require a greater level of care and increased financial resources. Therefore, reducing the length of hospital stay and the number of medical interventions required will maximise cost efficiency (Pierce et al., 1990).

Ethical Issues in Coma Arousal Procedures

Ethical issues may arise about a decision to stimulate, or not stimulate minimally responsive or unresponsive patients. The scientific viewpoint that equates mind with brain, and confuses 'not acting' with 'not perceiving' adds fuel to this debate. When in coma, physiological functioning is damaged and chaotic, and the patient may be living only with the aid of machines. Some researchers would state that these patients are neocortically dead and any attempt to rehabilitate them is 'clinical naivety' (Wood, 1991). Others believe, and post-coma survivors have testified, that during coma the 'self' is still present but exists in a disoriented state and needs to be reoriented (Ansdell, 1995; Boyle, 1989; Claeys et al., 1989; La Puma, Schiedermayer, Gulyas & Siegler, 1988). Some patients recall bedside conversations that took place whilst they were unconscious (La Puma et al, 1988), and Boyle (1983) reported at least one neocortically brain-dead patient who made consistent responses to music. La Puma et al. (1988) proposed that we should talk to comatose patients because they may hear and respond. These clinical and anecdotal reports inform a decision to stimulate patients in coma and may motivate the music therapist to use music to promote a response.

The question for music therapists, therefore, is one of humanity. Is it ethically appropriate to stimulate a patient in coma since we have no objective means to measure whether treatment techniques can alleviate pain or provide pleasure?

Sensory Stimulation Programs

Comatose patients have a need for an appropriate level of sensory stimulation (Wood, 1991), therefore it seems paradoxical that coma patients are at risk for both over- and understimulation from their environment (Kennelly & Edwards, 1997). An unconscious patient's capacity for selective attention is often diminished because of their head injury and they are unable to filter out irrelevant stimuli (Cohen, 1993; Wood, 1991). Thus overstimulation, such as the constant noise of nearby machines and medical interventions, may cause confusion, anxiety and a further retreat for an already disoriented person. Alternately, there is a risk for sensory deprivation through limited physical movement and minimal human contact (Aldridge, 1991a; Kennelly & Edwards, 1997). Sensory deprivation can produce "decrements in the structure, function and chemistry of the brain and concomitant deficits in cognitive function" (Mitchell, Bradley, Welch & Britton, 1990, p. 274), thus hindering recovery (Jones, Hux, Morton-Anderson & Knepper, 1994; La Puma et al., 1988).

Studies of auditory brain stem function of comatose patients show that "the majority have normal brain-stem auditory evoked responses, a recording of afferent

nerve impulses, regardless of the level of coma" (La Puma et al., 1988, p. 21), and thus may hear. They also have changes in heart rate, respiratory rate and intracranial pressure with auditory stimulation (Boyle, 1989; La Puma, et al., 1988).

The effectiveness of sensory stimulation programs for coma arousal is currently under debate in the medical literature (Wood, 1991). The controversial issues concern measures of outcome, such as the distinction between awareness and arousal. Sensory stimulation programs (Jones et al., 1994; Mitchell et al., 1990; Pierce et al., 1990) have been used to promote arousal and also to measure responsiveness. Most of these programs involve the five senses, and include pain-inducing stimuli, and the presentation of lights and various sounds, smells and tastes. A comprehensive review of fourteen studies evaluating sensory stimulation programs was completed by Wilson and McMillan (1993). Despite inconsistencies in definition of sensory stimulation and other methodological issues, the positive results in many of the studies indicated that such programs can alter behaviour in the unconscious patient and can reduce the duration of coma. These positive results included eye opening, improved motor function and vocalisation.

In terms of aural stimulation, studies in the medical literature use musical instruments that produce a single, loud, clear sound, such as horns, whistles, drums, woodblocks and tuning forks (Freeman, 1987; Mitchell et. al., 1990; Pierce et al., 1990). However, these aural experiences can hardly be described as music. These programs are based on the notion that increased volume or intensity of stimulation is more likely to force the patient to respond, however such stimulation procedures are used to test reflex responses rather than to encourage voluntary behaviour. These interventions appear to be grounded in a behaviouristic philosophy, as supported by Plum and Posner's (1980) statement that "behaviourally, one can estimate another's self-aware consciousness only by his response to the examiner's verbal commands or gestures" (p. 5). It is believed that if the patient can be stimulated to respond, then this indicates arousal and potential for recovery. This reasoning is problematic because although arousal is needed to achieve awareness, they are different conditions of cerebral activity. Arousal can mean that reflex responses or signs of wakefulness are present, however awareness involves cognitive processing or thought. Sensory stimulation should aim to facilitate awareness, rather than just increase arousal, because it is awareness that involves thought and "is related to measurable changes of behaviour" (Wood, 1991, p. 405). Wood and associates (1992; 1993) distinguish between *sensory stimulation* and *sensory regulation*. They believe that systematic sensory stimulation, as promoted in 'coma arousal procedures', is likely to overwhelm an unconscious patient's limited information processing capacity, causing confusion rather than awareness. The neural

response to sensory overload activates the habituation response which lowers awareness by decreasing vigilance (Wood, 1991). Rather than a continuous bombardment of multisensory stimulation, Wood suggests exposure to discrete, meaningful stimuli under carefully controlled conditions, with the reduction of all forms of extraneous noise. This also aims to decrease the potential for habituation to occur.

Having reviewed the literature on sensory stimulation and sensory regulation, it seems clear that the use of stimuli that are meaningful to the patient and presented in a regulated sensory environment, may be more likely to promote increased awareness and orientation to the environment. Music may be considered a *meaningful* stimulus for two reasons; first, it may be familiar, and second, it is able to match and respond to physical cues. Hence, if a music therapist focuses primarily on providing meaningful and regulated musical stimulation, intrapersonal rhythmic integration may occur as a consequence and therefore increase awareness. Sensory stimulation occurs as a byproduct of providing human communicative contact through music.

Music Therapy Approaches to Coma Arousal

The use of music to establish connections with persons in various stages of coma has been documented (Aldridge, Gustorff & Hannich, 1990; Boyle, 1989, 1994; Gustorff, (in Ansdell, 1995); Kennelly & Edwards, 1997; Rosenfeld & Dun, 1999; and Wilson, Cranny & Andrews, 1992). Music therapy methods employed have included:

* singing/playing familiar songs (and adaptations of these, involving word substitution and song parody),
* listening to recorded music,
* improvised singing/playing.

Singing/playing Familiar Songs

Kennelly and Edwards (1997) described techniques used in providing music therapy to children in coma. Familiar songs and adaptations of these songs were presented in order to increase orientation through the structured and ordered characteristics of familiar music. Opportunity was provided for engagement, stimulation, orientation and expression. Music therapy interventions elicited a number of responses from the comatose child, including; vocalisations, body movements, changes in breathing, eye opening and orientation to the therapist (Kennelly & Edwards, 1997).

Rosenfeld and Dun (1999) described music therapy intervention to hasten

emergence from coma and help orient children with severe brain injury. They believe that music therapy may provide a direct window to the injured brain via influencing the centres for emotion in the brain. A combination of live, familiar music and improvised singing techniques were used. Responses included: changes in heart rate, orienting to sounds and vocalising in songs.

Bright and Signorelli (1999) proposed that the use of familiar music with brain-impaired clients may have contraindications in that music may arouse traumatic memories that are unable to be resolved due to cognitive and communicative disabilities.

Recorded Music

A number of studies have utilised recorded music, and many adopted a behavioural approach. In a study with three patients in vegetative state, Boyle and Greer (1983) examined the effect of recorded music as an operant reward for complying with verbal requests to make lateral head, finger, and mouth movements. Two patients improved on at least two of the measured behaviours.

Another study by Boyle (1994) aimed to give patients in a vegetative state control over the playing of taped selection of music. She used preferred music as positive reinforcement for 'pillow pressing' behaviour, in order to encourage 'active' (patient initiated) rather than 'passive' (therapist initiated) responses. Results from learning curves were not consistent but anecdotal observations recorded successful responses.

Wilson, Cranny and Andrews (1992) used four single case experiments to examine the efficacy of preferred taped music as a form of stimulation in treatment of patients in persistent vegetative state. Significant behavioural changes in two cases included increases in body movements and vocalisations.

Improvised Singing/playing

Gustorff (Aldridge, Gustorff, & Hannich, 1990) used improvised wordless singing based on the pulse tempo and breathing patterns of five coma patients with a Glascow Coma Scale rating between 4 and 7. (GCS ratings range from 3-15, with a lower score indicating a more severe head injury. A score of 4-7 indicates either nil or reflexive responses to stimuli.) Staff were asked not to carry out any invasive medical procedures for 10 minutes after each session. During music therapy, reported EEG traces were assessed to show changes from theta waves (4-7 cycles per second, representing dream states) to alpha (8-12 cycles per second) and beta waves (18-40 cycles per second), thus suggesting arousal and perceptual activity. These changes faded out after the music therapy stopped. Other responses to this method included: changes in breathing (slower and deeper), fine

motor movements, grabbing movements of the hand, head turning, eye opening and even regaining consciousness (Aldridge, 1991b).

> When the therapist first began to sing there was a slowing down of the heart rate. Then the heart rate rose rapidly and sustained an elevated level until the end of contact. This may have indicated an attempt at orientation and cognitive processing within the communicational context. (Aldridge, 1991b, p.360).

It can be seen that various different music therapy approaches have been used with patients in coma. The advantage of using a behavioural approach such as that used by Boyle (1989; 1994) and Wilson et al. (1992), is that variables can be controlled (eg. recorded music) and results may be more objective (eg. pillow-pressing). However, the advantage of using live, improvised music in a humanist approach is that the music can be altered in the moment to match patient responses and encourage active participation and communication.

Rhythmic Entrainment

The intervention described above, using improvised singing (Aldridge, Gustorff, & Hannich, 1990), is informed by the principle of rhythmic entrainment. Entrainment is a phenomenon of sound, where the powerful rhythmic vibration of one object will pull the rhythms of another object into step with itself. For example, a room full of grandfather clocks with pendulums swinging at different times will lock rhythmically in step with one another after only a day (Goldman, 1992).

Aldridge (1989a, 1989b, 1996a) proposed that in very nature and structure, humans are musical; even on a physiological level, an underlying rhythmicity governs each bodily system (Koepchen, Droh, Spingte, Abel, Klussendorf & Koralewski, 1992). "Within our own bodies, we are constantly locking into rhythm with ourselves. Our heart rate, respiration and brain waves all entrain to each other ... all function harmonically ... their rhythms are strictly coordinated in whole number ratios" (Goldman, 1992, p. 197). This state of rhythmic entrainment may be disrupted as a result of stress or trauma. Aldridge (1989a) suggests that when the synchronous behaviour of the body becomes disorganised, pathology or ill health is evident. An integrated rhythmic hypothalamic response therefore is important in the healing process (Aldridge, 1989b).

Brain injury resulting in coma is an example of severely disorganised intrapersonal processes. The pulses of the healthy body are lively and accommodate other pulses to form interacting rhythms. This variability in pulse may become static for the patient in coma (Aldridge, 1996a). In such situations of dysfunction, music

therapy may promote stimulation, communication and reorganisation. The role of the music therapist is to use music, with its inherent power to organise, to assist the patient to entrain their working body rhythms as mentioned above.

"Complex human behaviours and movement patterns require a coordinating activity that is based upon pulse as it establishes a rhythmic pattern" (Aldridge, 1996b, p. 47). For pulses to be perceived as rhythmic, they need to be uneven in chronological time, unlike the fixed pulses of machine noises that surround coma patients. Improvised singing or music making may provide such a context because it has a different time structure. The principles of rhythmic entrainment suggest that an improvised melody line should be rhythmically predictable and match the rise and fall of a patient's breathing, because the patient's own rhythmic breathing pattern may provide the needed context for orientation (Aldridge, Gustorff, & Hannich, 1990).

The music therapist's goal is to discover the patient's own rhythmic structure and meet him or her musically within that structure (Aldridge, 1989b, 1996a). Rhythm is fundamental to communication, and rhythmic connection with someone is the first step in the communicative process (Aldridge, 1989b). Sacks (1998) suggested that music may act as a temporary 'prosthesis' for the basal ganglia, or even the cerebellum, when it is damaged, by stimulating temporal organisation and sequencing of movement, even in an unconscious person.

Using music to affect an unconscious person's cardiovascular system, may in turn affect their ability to receive information. Awareness of environment is partially regulated by interactions of the brain and the heart, hence it is possible to speculate that the heart rate may influence consciousness or awareness (Aldridge, 1996a). The relationships between brain activity and music are bidirectional: music is perceived by hearing it and the musical expression of human mental activity in turn stimulates the brain. In this bidirectional process, music may influence inner and outer biological rhythms on the basis of principles of entrainment (Koepchen, et al., 1992).

It follows then that if attention and perceptual activity are influenced by physiological factors that can in turn be influenced by the rhythmic and melodic qualities of music, music therapy may increase awareness and promote the regaining of consciousness in comatose patients.

Improvisational Music Therapy

The humanistic philosophy that informed Gustorff's work (Aldridge, Gustorff, & Hannich, 1990) is that espoused in the methodology of Creative Music Therapy (Nordoff & Robbins, 1977). Nordoff and Robbins (1977) emphasise music improvisation as the medium for establishing connection and communication with clients. This methodology has potential to be explored further in interventions

with comatose patients.

Improvised music "is created in the performance and, by its nature, is unforeseen, undetermined and unpredictable; a daring to create from the conditions of the present moment, without knowing where the journey will lead" (Ansdell, 1995, p. 24). The therapist is completely free to respond in the moment to any contribution or reaction of the patient. Some goals of improvisational music therapy are: awareness (of self, environment, others); perception and discrimination in sensorimotor areas; communication; and integration of self (Bruscia, 1987a).

Although Creative Music Therapy was initially developed for child clients, it aims to promote active participation and communication by both client and therapist (Nordoff & Robbins, 1977). Music therapy interventions aim to stimulate the comatose or vegetative state patient to respond with intentional rather than reflexive movements. This intentional behaviour requires a significant degree of self-involvement and increases the level of awareness.

Jochim (1994) suggests that a pre-verbal emotionally focused tonal language may establish contact with the unconscious patient and stimulate communication at emotional, social and cognitive levels. Communicative contact begins by matching the patient's inner condition with music (Bruscia, 1987b) thereby creating a musical environment with which the patient can connect. Outward behaviour and physiological responses are recognised by music therapists as a reflection of the patient's inner experience. The skill of the music therapist is to utilize the capacity of music to bypass external and physical limitations and reach deeper parts of the psyche (Wheeler, 1981); to understand the mind-body connection and to see past the patient's deficits and realise his or her abilities and possibilities. Sacks (1986) reminds us of this need for a balanced positive outlook when he says that "...however great the organic damage...there remains the undiminished possibility of re-integration by art, by communion, by unlocking the human spirit; and this can be presented in what at first seems a hopeless state of neurological devastation" (p. 37). Music has the power to organise and can thereby link brain, body and mind (Scartelli, 1992). In the clinical vignettes that follow, improvised music was used as the medium through which to achieve human contact, communication and integration. Bright and Signorelli's (1999) discussion of the potential contraindications of using familiar music with brain-impaired patients informed the decision not to also use familiar or pre-composed music.

Clinical Vignettes

Four brief clinical vignettes of music therapy will be presented to illustrate the application of improvisational music therapy in working with patients in coma. This

intervention aims to increase awareness and orientation to environment by providing 'meaningful', live musical stimulation. The work described was carried out in a Melbourne hospital which, among other clinical services, specialises in rehabilitation for patients with an acquired brain injury within a multidisciplinary framework. Each of these four patients demonstrated spontaneous eye opening and some movement and was thus classified as being in a vegetative state (Sazbon & Groswasser, 1991). All patients had a tracheostomy tube in place and required a high level of medical supervision and nursing interventions. Such patients were monitored for recovery by allied health therapists and received maintenance therapy rather than active, rehabilitation focused therapy.

The music interventions were kept very short (5-6 minutes) and simple so as not to overstimulate patients. This approach was based on Gustorff's work (Aldridge, Gustorff, & Hannich 1990), and that "the music has to be scaled down to [the patient's] cognitive and emotional capacity" (Ansdell, 1995, p. 60). The improvisations began with a simple melody in 3/4 time with repeating melodic phrases, taking the patient's breathing tempo as the starting point. Due to the minimal responses displayed, several sessions with each of the patients were observed by a second music therapist in order to objectify the observation of responses. These responses (or lack of response) were noted in the patients' medical files.

John, a twenty-three year old man, was three months post injury at the time I started to work with him. John had a tracheostomy tube in place and the sound of his breathing was loud and quite fast when I first saw him. I began by introducing myself and saying that I had come to sing with him. John's eyes were open but unfocused during this session. Whilst I was singing his breathing became quieter and slowed down noticeably. He appeared more relaxed and turned his head towards me. This first session was an indicator of John's response to the music in subsequent sessions. He would assume a relaxed facial expression (i.e., cease frowning) and his breathing would become slower and deeper. In a later session, when John had his eyes closed, he opened his eyes once when I began singing and again when I stopped. Whilst I was singing he was generally quiet, but after I finished he started coughing and moving around. At the end of another session, John opened his eyes and took a deep breath. These responses I considered to be indicative of John's awareness of myself and the music, and his orientation to my presence during music therapy sessions.

Akim, a thirty-four year old man, was three months post injury at the time I began working with him. Akim was of Indian heritage and his wife brought in some of his favourite Hindi music for me to listen to. In order to make the music more culturally relevant and familiar for Akim, I sang in a minor mode and used melodic

intervals and phrasing that were familiar to him. As with all the patients in coma, I matched my singing tempo and rhythm to the pace of Akim's breathing. The first time I saw Akim, his breathing pattern seemed irregular and was difficult to follow. However, once I had connected musically with his breathing rhythm, I was able to gradually decrease the tempo and his breathing became slower and more relaxed. Akim spent most of the sessions with his eyes closed, and although sometimes he made few observable responses, often he would open his eyes briefly and look at me when I began singing and again when I stopped. Akim also demonstrated some awareness of the music by pausing briefly at the end of a melodic phrase then breathing again with the start of the next phrase. The sessions were also helpful and enjoyable for Akim's wife who became involved through discussing his music tastes and providing tapes. She enjoyed observing music therapy sessions and seeing his responses.

Simon, a nineteen year old man, was five months post injury when I first saw him. He had very high muscle tone in his neck as a result of his brain injury, and subsequently had restricted head movement. Simon was able to open his eyes upon request, and when his neck relaxed enough for him to unlock his jaw, he was able to orient towards the music source and focus on me. During one session, where Simon was on a heart rate monitor, his heart rate was observed to increase significantly if he was startled (e.g., when I unintentionally bumped the bed) and to decrease when listening to the music. Simon was only on the heart rate monitor during one music therapy session, so this response was not able to be measured again. Similar to John and Akim, Simon would often open his eyes after I finished singing, demonstrating awareness of the music. In addition, Simon was often able to focus on me while I was singing and sustain focus and visually track the movement of my head when I moved position, indicating an orientation to the music, and myself as its source.

Not all patients respond to music therapy intervention however. Matthew, a twenty-five year old man, was five months post injury when I began seeing him. After four weekly sessions of improvised singing intervention with Matthew, and observing no response to the music, his sessions were discontinued. The intervention used was no different than for the other three patients I saw and it may be that the method (improvisational music therapy) was not appropriate for him. However, Matthew had displayed low responsiveness during his entire period of hospitalisation. After observing no response to the music, and following discussion with members of the treating team, it was decided that the severity of Matthew's brain damage made it unlikely that he would make further improvements in functioning. Matthew is now eighteen months post injury and has made no observable progress in orientation or awareness.

Conclusion

In conclusion, it can be stated that there is clearly a need for further research to be done in this area. Studies using various music therapy methods and coma arousal techniques should be carried out. Adequate documentation of music therapy techniques and subsequent patient responses and objective comparison of results must be recorded. Anecdotal reports from patients who have regained consciousness also support the validity of music therapy interventions (Ansdell, 1995).

It is difficult to quantify results or establish a behavioural baseline from which to measure improvements because of the minimal nature of responses. The challenge for music therapists to demonstrate benefit for comatose patients may best be met through the construction of a music therapy behavioural assessment scale describing a continuum of awareness. This could be based on the Glascow Coma Scale and would provide objective measurement of results and complement anecdotal recording. The therapist could incorporate frequency and/or duration recording to demonstrate systematic responses and graph these responses to examine linear trends in the data (Boyle, 1995). This scale would also assist music therapists in the evaluation of programs and in justification for continuation or termination of treatment.

Within the medical model, it has been shown that music, as a form of aural stimulation, can increase arousal in comatose patients. However music therapy may offer benefits in addition to sensory stimulation alone. Physiological functions including heart rate, respiration and brain wave patterns are affected by music and in turn affect awareness. In addition, improvisational music therapy may promote communication with comatose patients, and the use of rhythm may facilitate personal and interpersonal integration. As a holistic model, improvisational music therapy recognises communication between mind and body. In the case where that connection is broken, confused, disorganised or disrupted, music therapy may be a viable medium through which organisation may be regained.

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