

Full-Length Article

Evaluation of the Standardized MUSIC CARE® App in the Treatment of Pain: *The U-Shape****Composing Technique***Stéphane Guétin^{1,2,3}, Daniela Falvay⁴, Gérald Chanques⁵, Samir Jaber⁵, Sylvie de Lattre⁵, Bruno Souche⁵, Patrick Giniès⁶, Marie-Christine Picot⁷, Christian Hérisson⁸, Luc Brun⁹, Emmanuelle de Diego¹⁰, Jacques Touchon¹¹Department of Neurology, Centre Mémoire de Ressources et de Recherches (CMRR), Montpellier University Hospital, Montpellier, France²Association for Music Therapy Applications and Clinical Research (AMARC), France³Department of Psychology (LCPL), Paris University- Renée Descartes, Paris, France⁴SRH University Heidelberg, School of Therapeutic Sciences, Heidelberg, Germany⁵Department of Critical Care Medicine and Anesthesiology (DAR B), Saint Eloi University Hospital, CHU Montpellier, France⁶Department of Pain, Hôpital Saint Eloi, CHU Montpellier, France⁷Department of Medical Information (DIM), CHU Montpellier, France⁸Department of Physical Medicine and Rehabilitation, Lapeyronie hospital; CHU Montpellier, France⁹Department of Pain, Territorial Hospital, Nouméa, New Caledonia, France¹⁰Department of Pain, University Hospital, Réunion Island, France**Abstract**

Numerous studies emphasize the application of music therapy and music medicine in the treatment of pain. The MUSIC CARE® app that was designed at the University Hospital of Montpellier applies the U-shape music composing technique taking into account the available evidence of the literature on relaxation paradigms. The main objective of this article is to summarize recent research on the standardization and evaluation of this new app of music medicine in the treatment of pain. Following a comprehensive review of the literature, a series of controlled, randomized, multi-centered studies were conducted including patients seeking care in such diverse setting as rheumatology, functional rehabilitation, oncology, geriatrics, anesthesiology and intensive care, neurology, obstetrics, pediatrics and general pain treatment. The effect of the MUSIC CARE® app has been evaluated on different types of acute and chronic pain of various origins (i.e. mechanical, inflammatory and neurological fibromyalgia). Physiological effects on hemodynamic and respiratory markers as well as psychological outcomes, including the relationship between care-provider and patient have been emphasized within multiple trials. The MUSIC CARE® app reduces pain, anxiety and depression to a significant degree and decreases the need for anxiolytics and antidepressants. Our first randomized controlled trials demonstrate the benefit of using MUSIC CARE® application in the management of pain. Future directions for the use of the app in various settings are discussed.

Keywords: *Music Care, Pain, Anxiety, Relaxation, Composing Technique*multilingual abstract | mmd.iammonline.com**Introduction**

Since prehistoric times healers have used music in the adjuvant treatment of patients [1]. Between 1500 and 1600 BC, Egyptian hieroglyphics provide incantations for curing infertility, rheumatic pains and insect bites with the use of music. At the end of the 19th century, dentists used music to decrease pain intensity, discomfort, and complaints of anxiety as well as the frequency of nausea by using music. In 1960, these observations were confirmed by Gardner [2], who reportedly reduced pain in 90% of 5000 patients, by providing recorded music experiences for patients to utilize during dental surgery. Since then, these results have been replicated in various types of acute and chronic pain [3]. Beginning in the early 1990s, the re-introduction of music

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Stéphane Guétin, PhD, 8 rue La Vacquerie - 75011 Paris, Tel: (+00 33) 06 20 47 67 57, Email: s.guetin@music-care.com | COI statement: The authors declared that no financial support was given for the writing of this article. The authors have no conflict of interest to declare. Stéphane Guétin is the CEO of MUSIC CARE®, he was not involved in contact with clients or analysis of data. The authors have no conflict of interest to declare.

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International Association for Music & Medicine (IAMM).

therapy and music medicine has been established in many medical procedures and particularly in the treatment of pain - attracting interest in the literature [4-10]. Numerous researchers have sought to identify the main factors of effectiveness of music medicine as well in this particular field of treatment [11]. It is known that music affects the cognitive component, diverting attention from pain, as emphasized by the Gate Control Theory. A recent meta-analysis has highlighted the influence of music on cognitive functions, stating that music is the most effective mediator of emotional processing. This suggests, that music that is pleasant for the patient may help to reduce the overall sensation of pain [11]. The impact of music therapy may also be explained by its specific neurophysiological effects [12], including 5 active components:

- (1) sensory (against causing stimulation of afferent fibers)
- (2) cognitive (often diverting attention by creating images and thoughts away from pain)
- (3) affective (mood-altering associated with conditions such as depression or anxiety and thereby reducing tensions and feelings of anxiety)
- (4) behavioral (acting on the muscle tone and psychomotor)
- (5) and psycho-social also involved in the reduction of chronic pain phenomenon: the music is chosen according to personal preferences of the patient, meeting individual demands. In addition to verbalizing emotions music may further help to release tension and promote communication [13] (Figure 1).

The aim of the present report is to summarize the efforts undertaken to evaluate a new technique of music therapy in the treatment of pain: the U-shape composing technique.

Methods and Results

Standardization of technical therapeutic music interventions to assist in the management of pain may serve to be useful as a treatment strategy. Numerous factors, stemming from scientific recommendations, enable the use of music therapy, which is an optimal intervention. The main characteristic of a successful music medicine application, however, seems to be related to the selection of a musical performance based on the patients' preference and cultural background with respect to the genre of music that is selected [14]. Instrumental music sessions between 20 to 60 minutes, consisting primarily of harmonic variations (i.e, rhythmic and melodic) are recommended. Patients should place themselves in a relaxed position (i.e., lying or recumbent) and use closed headphones combined with an eye mask [15]. While, music interventional sessions are often applied by a large variety of health care professionals – particularly when recorded music is recommended, it is often nurses that apply the music recordings- [1,14,15]. The consultation with or supervision by a professional trained music therapist is strongly encouraged.

Based on these considerations a standardized receptive music therapeutic relaxation technique has been developed at the University Hospital of Montpellier: the U-shape composing technique. The musical sequence, varies from 20 to 60 minutes, is divided into several stages that progressively enable the patient to relax according to the technique of a mounting U [12,16, 17] (Figure 2). The technique is based on the reduction of musical rhythm, orchestral, frequency and volume (downward phase of the "U"), with increasing relaxation. A maximum relaxation phase (lower part of the "U") is followed by a re-energizing phase (ascending limb of the "U"). All musical sequences have specifically been designed by Music Care®.

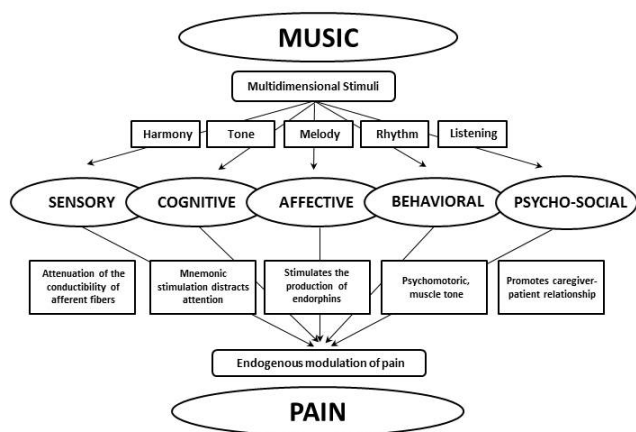


Figure 1. Main modes of psychophysiological measures of music therapy

Stimulating rhythm

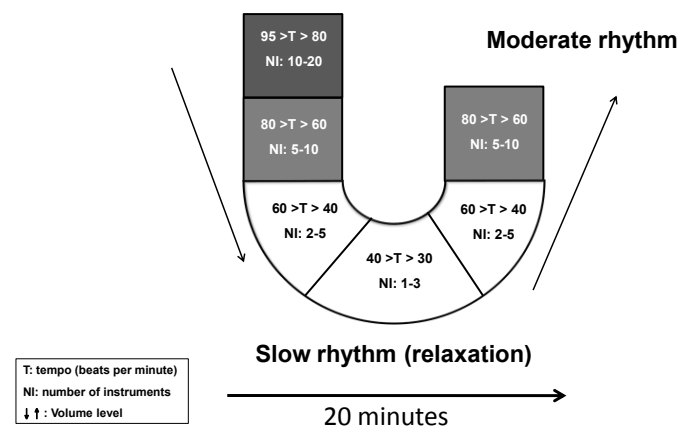


Figure 2. Technical standardized music therapy. The "U" sequence

The proposed method and the objectives are explained to clients during a first assessment interview. In order to gain a better understanding of the patient’s musical preferences a questionnaire is used to assess the clients favorite genres of music and previous experience with music (i.e. active music making). During the course of the study in hospitals, health care professionals are rigorously trained and have tablets with a variety of therapeutic music sessions (U-shape) available through the MUSIC CARE® app, to meet the patients preferences and needs. This choice of musical styles to meet the demand of patients using a simplified questionnaire allows individual customization and further promotes a therapeutic relationship (Figure 3).

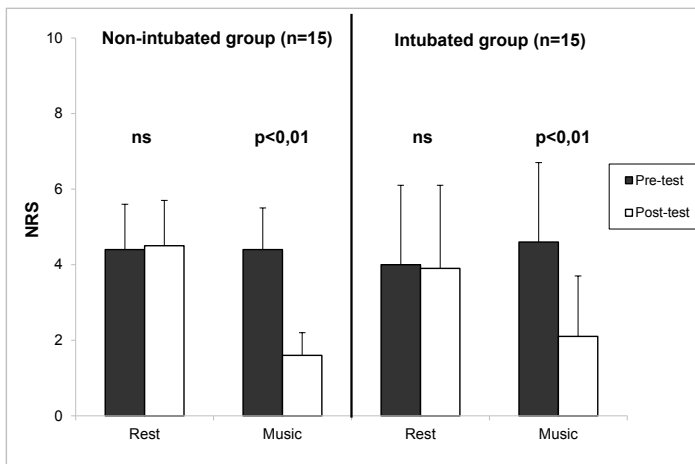


Figure 3. Acute pain; Mean values of pain levels for each group of patients (intubated and non-intubated) obtained before (pre) and after (post-test) each study session [10]

Evaluation of the effectiveness of music therapy on acute and chronic pain

This technique revealed good effectiveness in the treatment of chronic pain [12] and acute pain [17]. In acute pain, the main results of these randomized controlled trials report outcomes on physiological variables, such as heart rate, breathing, blood pressures (systolic, diastolic and mean) and bispectral index (BIS). The results show that the therapeutic music programs have helped to promote a state of relaxation and reduced pain intensity on an average of 50%, assessed by Visual Analogue Scales (VAS) [17] (Figure 3).

In the context of chronic pain, the results of a controlled study, showed promising results on reducing the intensity of pain (VAS) (p <0.001) and specifically on decreasing the consumption of anxiolytics and antidepressants (Figure 4) [11]. In the music therapy group, the proportion of patients consuming anxiolytics decreased from 90.9% to 42.9% in a 60 day follow-up (-53%). In the control group these proportions are respectively 79.1% and 66.7% (-16%). Another randomized controlled trial in chronic low back pain patients has shown that the beneficial effects improved with the

increasing number of sessions. And 76% of patients reported improvement in the first session of music therapy, 73% in the second, 88% improved in the third and 94% in the fourth session [12].

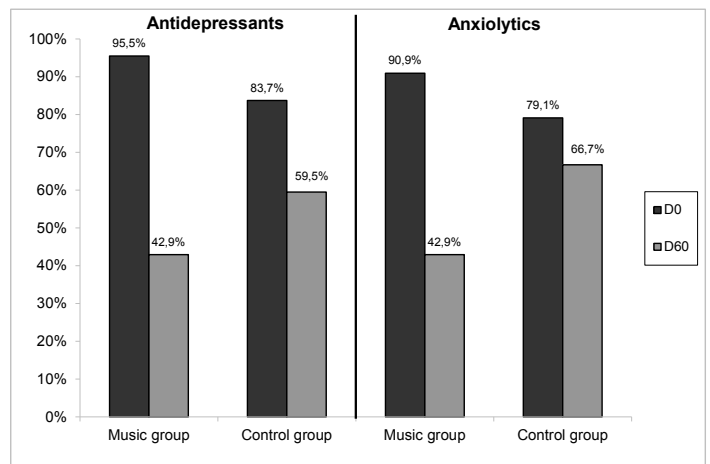


Figure 4. Chronic Pain: Percentage of patients who consume antidepressants and anxiolytics D0 and D60; Controlled, randomized, single-blind (n = 87). The music therapy group participate in daily music therapy in addition to standard treatment between D0 and D60. The control group received the standard treatment between D0 and D60.

The effectiveness of this music technique on anxiety and depression was also demonstrated in a randomized controlled trial in people with Alzheimer’s disease [19]. In a more general way, it would be interesting to assess the impact of the program on pain in non-communicating elderly. The pain is very difficult to assess in these patients, as there is still inconclusive evidence on the onset of behavioral changes associated with Alzheimer’s disease and those related to poorly managed pain due to non-verbalization of the pain by the patient. According to the literature, fewer analgesics are prescribed to elderly people with dementia. Thus, for these people, this program may support the management of pain and may help to indirectly reduce psycho-behavioral disorders such as agitation, wandering, anxiety and depression.

Applications of music therapy in the management of pain

The Association for Music Therapy Clinical Research and Applications (AMARC) in collaboration with the Centre for Memory Resources and Research (CMRR) and the communication service of University Hospital of Montpellier have developed a network that extends throughout the care hospital. All hospital rooms of the Evaluation Center and Pain Treatment as well as certain services at Neurology and Anesthesia and Intensive Care units are equipped with this new technology. At the Territorial Hospital in Noumea, there are also 15 departments fully equipped, including the Interventional Radiology, Obstetrics, the Stomatology, Unit

Ambulatory Medicine, Pediatrics, and others. Currently, this therapeutic music program is primarily used in the context of nursing, implemented in app connected to the internet -which enables regular updates and the assessment of accurate statistical data. The terminal provides access to a library of various musical libraries, adapted to patients' requests. Organized in several selections, the patient chooses individually or with the help of a trained nurse, a U-shape session corresponding to a musical style of his preference (i.e., classical, jazz, world).

The use of an interface linked to Internet provides several advantages. It is mainly used to control the number of broadcasts of sessions per room and consequently for each patient. All data concerning the use of this music therapeutic terminal are processed in this manner for statistical analysis. The number of sessions per patient, the choice of sessions based on the patient's socio- demographic data, the available clinical records as well as other clinical parameters such as pain intensity and level of anxiety are synchronized. Depending on the most widely used sessions, the goal is to build a music database for the application of the MUSIC CARE® app.

As part of a wider development of this technique, larger multicenter studies are in progress at the national and international level. All of the inter-center data are aggregated and will provide a growing database. The results will enhance the understanding of the influence of music during particular periods of treatment and care.

Discussion

Research has demonstrated the usefulness of music medicine in management of pain [20,21]. In line with existing evidence, our results confirm the beneficial effects of therapeutic music programs on pain. They also confirm the effectiveness of music programming on sensory cognitive, emotional, behavioral and social pain components. Using the U-shape technique has several advantages:

- This music therapeutic technique is adaptable to patients with different cultural background, beyond language borders. It can also be used in non-communicating people (loss of meaning of words and verbal language) with dementia of the Alzheimer type, as musical abilities are generally preserved.
- It can be performed individually. This is essential because it is difficult to get some patients' agreement to group sessions conducted in hospitals in context of other relaxation techniques.
- Finally, the music therapeutic sessions do not require the caregiver's presence throughout the procedure but only at the beginning (installation of the patient) and end of the session (verbalization of feelings), allowing a better time management for the nursing staff.

Our results can also be compared to results obtained by evaluations of other relaxation techniques. Many studies show

the impact of relaxation therapy [22] or hypnosis [23] in the context of pain treatment. Modes of action of the technique of receptive music therapy we used can be compared to those of the techniques mentioned earlier. The aim is to modify the state of consciousness using positive suggestions. Here, verbal suggestions are replaced by a musical induction - the archaic model of language. This musical induction tailored to the patient's emotional and affective preferences, will gradually bring the patient into a hypnotic and relaxation state by variations in musical elements such as rhythm, frequency, and volume.

Individual receptive music therapy is also an effective means of enabling patients at the end of the session to express their emotions felt during the listening part. Music processing acts here as a catalyst, allowing patients to verbally express their pain. Music used therapeutically therefore is an effective treatment aiming toward optimal psychophysiological changes in the pain patients may experience.

The literature shows that the impact of therapy is variable depending on the study [3]. It is important to note that most of these studies don't take the patients' musical preferences into consideration. It has been repeatedly demonstrated that the selection of a particular music varies between patients but also between different intervention sessions of one patient. These days, it is indispensable to provide several musical styles in order to best match the emotional and affective component of the patient [3,11-18]. This is undoubtedly, one of the main factors predicting the success of a music therapy session.

While the effect of music therapy in the treatment of pain has been demonstrated, this research also allowed validating the specific parameters of success, to evaluate the long term effectiveness and to develop a music database to meet the patients individual preferences. Taking into account the ease of implementation and low cost of use, combined with a lack of side

Conclusion

MUSIC CARE® app using U-shape technique changes the painful experiences through sensory, cognitive, emotional, behavioral and social effects, integrating perfectly into multidisciplinary care. The technology of the app, allows an extension of the use of therapeutic music for all patients. Further studies are currently in preparation, thus contributing to the reconnaissance of music therapy specific intervention programming and music medicine in the treatment of pain. Currently, many health centers, public hospitals and clinics are already using this technique. These centers participate in multicenter studies, leading us gradually to a better understanding of the effect of music on the human body and especially the pain.

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Biographical Statements

Since 1999, Stéphane Guétin, a music therapist who holds a PhD in Clinical Psychology, has been focusing his efforts on evaluating the benefits of music therapy by conducting numerous clinical research studies that have been presented at international congresses and published in international journals. In partnership with Montpellier University Hospital (INSERM U1061), MUSIC CARE has developed innovative music therapy and music intervention solutions that can effectively relieve pain, anxiety and depression in hospitalized patients.