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## The relationship between music and musculoskeletal chronic pain

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### ABSTRACT

Musculoskeletal chronic pain causes suffering and influences an individual's quality of life, functioning, and independence. The purpose of this descriptive, comparative, and correlational study was to examine the effect of music on the intensity of musculoskeletal chronic pain among women with musculoskeletal chronic pain, and identify symbolic themes similarities and aesthetic reactions caused by mental images after listening to three music pieces (*Bolero*, *Lohengrin*, and *Mix*). Data were collected from 90 women suffering from specific chronic musculoskeletal pain (fibromyalgia, repetitive strains injuries, and spinal column diseases) using the Numerical Rating Scale. Differences in perceptions of pain were measured before and after classical music listening (*Bolero* – M. Ravel, *Lohengrin* – R. Wagner, and *Mix* – classical various). Drawing and verbal reports were also recorded to characterize mental images. Results of *t*-tests indicated that women in the three groups had less pain after listening to the music pieces ( $p < 0.001$ ). Symbolic and aesthetically significant differences among the three musical pieces were also observed. The mix has shown lower results in mental image quantity in relation to Ravel and Wagner's music, both symbolically and aesthetically, with predominance of descriptive images. These findings indicate that music is an effective nursing intervention that can be used to relieve musculoskeletal chronic pain.

**Descriptors:** Music therapy, Chronic pain, Alternative therapy.

## INTRODUCTION

Pain is one of the most prevalent and costly health problems. When it persists beyond the usual course of a disease or normal healing time for an injury, or when it is associated with a progressive disease, pain may be termed chronic. Traditional medical interventions have been largely unsuccessful in relieving chronic pain in part because they have focused only on organic factors ignoring the completely of the syndrome. The health care providers have recently recognized this and have been to develop and apply interventions, which address the psychological as well the physiological components of pain. Because individuals with chronic pain have a difficult time in controlling their pain, the focus of this study will be in chronic musculoskeletal pain.

Several researchers<sup>1-5</sup> noted that the use of music, as a complementary measure, is an effective intervention to control pain. Music is considered as an important strategy on health care humanization as well<sup>6</sup>. Other important function of music is to provide emotional experiences to listeners, performers, and composers. *"The emphasis in this field has been upon the quality of emotional response, for example, research has addressed what type of responses are evident to music, the similarity between emotional responses to music and those to other eliciting situations, the associations between particular musical structures and consistent emotional responses, and the function of the music-bases emotional responses"*<sup>7</sup>. Different types of music can produce different outcomes and how the music affects painful musculoskeletal disorders has not been convincingly demonstrated. Traditional medical interventions have been largely unsuccessful in relieving chronic pain in part because they have focused only on organic factors ignoring the complexity of the syndrome. The health care providers have recently recognized this and have begun to

develop and apply interventions, which address the psychological as well as the physiological components of pain. Pain and emotions, music and emotions, and music and mental images go around together.

Chronic pain is a complex experience and findings supported pain management theory that both nonpharmacological and pharmacological methods are needed<sup>2</sup>. Investigators who examined the effect of classical music on osteoarthritis pain in elders found significant decreases in pain among experimental group participants when compared with the control group on the pain descriptor section of the Short Form McGill Pain Questionnaire (SF-MPQ) and the visual analogue portion of the SF-MPQ<sup>4</sup>. Others researches also demonstrated that pain perception is decreased when surgical patients listen sedative music on days 1 and 2 after surgery<sup>2</sup>. Studies have demonstrated that music can reduce the perception of pain, however, the types of music most effective not always clearly indicated.

Also, we can infer the influence of music over the physical and mental dimensions of humans, but more than that, it is inferred that music can produce in individuals the benefits that transpire in the imagination, as well as lead them to have an experience of an aesthetic nature. *"Music can help to eliminate pain, serving as an imaginary sanctuary - a safe refuge - against pain. It helps to reduce stress and tension and it induces relaxation. It activates the production of endorphins and helps the mind to create images, allowing to temporarily escape to a 'world without pain', under the shelter of the imagination"*<sup>1</sup>.

Most everything we think of, be it people, objects or situations, real or imaginary, as well as our memories, are accessed by our conscious in the form of mental images. Music is also correlated with the imagination<sup>8</sup>. In our clinical experience, the verbal reports given by patients

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are always filled with innumerable mental images, accompanied, and almost always with the report of the relief of pain when submitted to classical musical listening too. Beyond the wealth of details in the descriptions of those mental images, we probed those images on paper with reference to the phenomenon of pain. Would music hold different potentials to evoke images? Would there be a similarity among those images? What would be the relationship among music, evoked images, and perception pain? To treat mental images scientifically is not an easy task<sup>9</sup>, because we hit upon methodological limitations due to the constant challenge offered by methodological limitations. However, these same difficulties add to the fascination and flavor of the object to be investigated, especially in the case of music and the mental images it evokes.

## METHODS

### *Purpose and Design of the Study*

A descriptive, comparative, and correlational design was used to investigate the effects of music on the intensity of the pain among women with fibromyalgia, repetitive strain injuries (RSI) and spinal column diseases; and, identify symbolic theme similarities and aesthetic reactions due to mental images originated from three musical pieces (*Bolero*, *Lohengrin*, and *Mix*).

### *Sampling*

The study used a convenience sample of three groups of women with musculoskeletal chronic pain: fibromyalgia (n=30), RSI (n=30) and spinal column diseases (n=30). Subject's age ranged from 22 to 81 (M = 45.5, SD = 11,68). A statistical consultant calculated the sample

size. For one point differences detection in repeated measures design, 81 (80+1) patients guarantee 70% of power for ANOVA unicaudal with significance level of de 0.05, "intraclass correlation coefficient" (r) of 0.80, "critical effect size" (D) of 0.25, "Glass's Effect Size" (d) of 0.52. In contingency tables for comparisons of observed frequencies in groups "fibromyalgia", "RSI" and "spine"; "mental images vs music" and "aesthetic reaction vs music", In wich case, 41 patients are enough to guarantee expected frequencies of 5 cases in 80% of cells, for unicaudal chi-squared tests of hierarchical hypotheses based on fitted marginals, alfa level of 0.05<sup>10</sup>. The result of this analysis suggested that 90 patients (30 in each group) was sufficient to determine whether or not music would have a significant effect on patient's pain. Inclusion criteria were gender (female), age (over 18 years old), diagnosis (musculoskeletal chronic pain), duration with chronic pain (at least 6 months), ability to hear music, and willing to volunteers to participate in the research.

### *Variables and Research Instruments*

#### *Pain intensity*

Pain scales are used to monitor and to faster communication between patient and their health care providers by using the 0-10 point scale, people have a means to communicate their pain intensity.

Numerical rating scale (NRS) adopted in this study has consistently demonstrated their validity as pain intensity measures by their positive and significant correlation with other measures of pain intensity, and their sensitivity to treatment effects<sup>11</sup>. Numerical rating scales are easier to understand and use than Visual Analog Scale (VAS), so they can be used with a great variety of patients. They are also extremely easy to

administered and score and many patients are familiar with the concept of rating pain intensity on a 0-10 scale<sup>12</sup>.

### *Mental Images*

Great variety of images we create when listening music. The music can to open the line of communication between collective unconscious and conscious communication system mediated by represented mental images<sup>13</sup>.

Patient's drawings have been used for assessment of emotional status<sup>14</sup>, psychological evaluation<sup>15</sup> and the effects of an auditory subliminal message upon the production of images<sup>16</sup>. However, there is little evidence for the reliability and validity of drawings assessments. This is mostly because a given feature could plausible support several and various interpretation<sup>15</sup>. We even so believe that patient's are valuable tools for investigation symbolic content. In addition, drawings can reveal music associated imaging objects. In this study we evaluated the number of mental images originated for each music piece and thematic categories were created. Interpretative approach was not developed; only symbolic and aesthetic classifications were done.

Thus, all the objects drawn were categorized and quantitatively grouped, like the objects mentioned of verbal reports. The objects represented in the drawings were quantitatively grouped into symbolic categories (Dictionary of symbols based)<sup>17-18</sup>, and mental images reported were classified into three aesthetic categories: pleasure, displeasure, and descriptive images. The quantitative approach was adopted for all variables.

### *Procedure*

Following institutional review board approval, names of potential volunteers were ob-

tained from collaborating physicians. Potential subjects were contacted by telephone to explain the purpose, benefits, and risks of the study, and invite them to participate in the research. If the subject agreed to participate in the study, a music session date and time were scheduled. Prior to data collection, the Committee for the Protection of Human Subjects approved the research proposal. After permission was obtained from this committee, informed consent was obtained from each of the subjects meeting the sample criteria who were willing to participate in this study. Each patient was identified by a code to ensure anonymity. All data obtained during the course of this study were kept confidential. All music sessions took place in private room at the Institute of Orthopedics and Traumatology of the Hospital of Clinics of the School of Medicine of the University of São Paulo. The measurement of pain was recorded from these individuals in response to the three musical pieces used in the study. Subjects listened sequentially and individually musical session for an uninterrupted period, for 21 minutes approximately. The tape consisted of three musical selections adopted in this study and were chosen according to patient's preference observed in a previous study<sup>19</sup> and was based on classical compositions to played by outstanding performers. The control music denominated as *Mix* consisted of diverse classical music extracts, in opposition to the highly defined musical structures of the other two pieces. The three musical selections used in the study were: *Bolero* (Composer: Maurice Ravel - Performer: Kenneth Jean/ Slovak Philharmonic Orchestra - 5'51"); *Prelude to Act I - Lohengrin* (Composer: Richard Wagner - Performer: Otto Klemperer/P.Orchestra - 9'56"), and *Mix* (Composer: Classical Various - Performers: Alfred Scholz Alfred Scholz / London Festival Orchestra; Alberto Lizzio/ Orchestra P. Slavonia; Peter Falk / Wiener Volksopen Orchestra,

and Lawrence Siegel/ New P. Orchestra – 5'17")

During each musical piece, the women were requested to draw the images that took place in their minds while they listened to the music. At the end of each musical piece, the subjects were solicited to describe those images and verbal reports were recorded. Using the NRS subjects reported their pain scores before and after the musical session. Anonymity and confidentiality was maintained by using numbers to identify participants rather than names and only members of the research team had access to subjects' data.

## DATA ANALYSIS

The WinSTAT Statistics for Windows, Minitab Release 10.1 and Statistical Program for the

Social Sciences (SPSS Inc. 1999) were used to analyze the data. Analysis of variance (ANOVA), repeated measures was used to determine post music differences existed among groups (Lohengrin, Bolero, Mix) with Analysis of Covariance ANOCOV for the covariate "pre-music"<sup>20</sup>. Qui-squared test was conducted for each group to determine association between the music session and pain relief, music and mental images association and music and aesthetical reaction association. All results were considered significant on a significance level of  $p < 0.05$ .

## RESULTS

The Table 1 shows the distribution of the effect postmusic on the pain intensity.

Table 1 - Distribution of the Effect of Musical Listening on the Intensity of Pain. São Paulo, 2004.

	Fibro	RSI	Spine
Decrease	19	14	19
no alteration	11	16	11
<b>Total</b>	<b>30</b>	<b>30</b>	<b>30</b>

Source: authors

The chi-squared test tested association between diagnostic and postmusic pain intensity score. There was no significant group differences ( $N = 90$ ,  $\chi^2 = 4.40$ ,  $df = 2$ ,  $p > .05$ ).

The ANOVA repeated measures with ANOCOV for the covariate "pre music" demonstrated a significant decrease in the intensity of pain perceived by 3 groups {Lohengrin ( $3.07 \pm 2.96$ ) = Bolero ( $3.05 \pm 2.91$ ) < Mix ( $3.56 \pm 2.97$ )}, { $F[2, 178] = 7.76$ ,  $p < .05$ }. The most differences evidence were observed after adjustment for the

covariate "pre-music" ( $9.67 \pm 8.51$ ) { $F[2, 177] = 182.70$ ,  $p < .05$ }. Fisher lsd showed Lohengrin = Bolero { $F[1, 267] = 0.01$ ,  $p > .05$ }, both music pieces < Mix {Lohengrin vs mix :  $F[1, 267] = 11.24$ ,  $p < .05$ ; Bolero vs mix:  $F[1, 267] = 12.02$ ,  $p < .05$ }, for each one of three music pieces < "pre-music" {Lohengrin vs pre-music:  $F[1, 267] = 128.90$ ,  $p < .05$ ; Bolero vs pre-music:  $F[1, 267] = 131.51$ ,  $p < .05$ ; mix vs pre-music:  $F[1, 267] = 64.01$ ,  $p < .05$ }. The Table 2 shows the distribution of the symbolic categorization of the objects drawn.

The Table 2 shows the distribution of the symbolic categorization of the objects drawn.

Table 2 - Symbolic Categories Distribution for Number of Objects Drawn According to Musical Listening. São Paulo, 2004.

Objects classified into symbolic categories (symbolic representation for each object drawn)	Bolero	Lohengrin	Mix
Life / Death / Regeneration / Transformation	90	81	57
Maternal	75	74	41
Spirituality	77	79	41
Center	21	41	16
Pureness	05	10	00
Totality / Perfection	07	08	04
Pain	03	06	03
<b>TOTAL</b>	<b>278</b>	<b>299</b>	<b>162</b>

Source: authors

The chi-squared test in the comparison of the total of drawn objects revealed significant differences among the three musical pieces ( $N = 739, c^2 = 44.20, df = 2, p < .05$ ).

The chi-squared test showed significant association between aesthetic reaction (A) and musical piece (B). The null hierarchical hypothesis of independence ( $\bar{A} \text{ } \bar{A}$ ) between observed frequencies was rejected ( $N = 523, c^2 = 304.114, df =$

$4, p < .05$ ). The equiprobable hypotheses among aesthetic reaction types for a same music piece ( $\bar{A} = f | \bar{B}$ ) and among one aesthetic reaction type and each music piece ( $\bar{B} = f | \bar{A}$ ) were rejected ( $\{N = 523, c^2 = 488.118, df = 6, p < .05\}$  and ( $N = 523, c^2 = 227.490, df = 6, p < .05$ ), respectively).

The Tables 3-5 show the chi-squared tests values for comparisons among three music pieces and each aesthetic reaction type.

Table 3. Chi-squared tests values for comparisons among three music pieces and pleasure reaction, with N values in parentheses, significance level of 5%, one degree of freedom. São Paulo, 2004.

	Bolero	Lohengrin	Mix
Bolero	----	2.051 <sub>(236)</sub>	8.205 <sub>(176)</sub>
Lohengrin	----	----	18.182* <sub>(198)</sub>
Mix	----	----	----
* significant			$c^2_{0,95} = 3.841$

Source: authors

Table 4. Chi-squared tests values for comparisons among three music pieces and displeasure reaction, with N values in parentheses, significance level of 5%, one degree of freedom. São Paulo, 2004.

	Bolero	Lohengrin	Mix
Bolero	----	16.000* <sub>(100)</sub>	0.925 <sub>(53)</sub>
Lohengrin	----	----	23.753* <sub>(93)</sub>
Mix	----	----	----
* significant			$c^2_{0,95} = 3.841$

Source: authors

Table 5. Chi-squared tests values for comparisons among three music pieces and descriptive reaction, with N values in parentheses, significance level of 5%, one degree of freedom. São Paulo, 2004.

	<b>Bolero</b>	<b>Lohengrin</b>	<b>Mix</b>
Bolero	----	14.286* (28)	20.319* (91)
Lohengrin	----	----	55.901* (71)
Mix	----	----	----
* significant			$\chi^2_{0,95} = 3.841$

Source: authors

## DISCUSSION

The musical listening, in this study, led to a significant statistical reduction on patient's perception of pain (all groups), results corroborated by several authors in the relief of other chronic or acute pain<sup>2-5,21-22</sup>. Among the mechanisms that are cited to explain the relief of pain, the distraction, the alteration of perceptual focus, the liberation of endorphins and relaxation<sup>2</sup> or catharsis<sup>23</sup> are included. The systematic review about the effectiveness of music as an intervention for hospital patients demonstrated the effectiveness of music for reducing the anxiety of hospital patients<sup>22</sup>. Anxiety increases muscle tension and it is usually a factor of aggravation of pain. The anxiety reduction results pain relief.

Studies provide evidence that music is an effective tool to decrease pain. When patients continued to listen to the music daily for weeks the pain continued decreased. Because listening to music can easily be used in community settings, it can be considered an effective nursing intervention for those elders with chronic pain from osteoarthritis<sup>4</sup>. Our findings indicate additional diagnose (musculoskeletal chronic pain) appropriate for this intervention.

Others researches rationalize the supporting use of music to reduce the unpleasantness of a pain experience, too. This explains the involvement of the limbic system that contributes to the emotional response of pain perception<sup>24</sup>.

The selected music presented potential to evoke differentiated images among the structu-

red music (*Bolero* and *Lohengrin*) and *Mix*, which lead each listener to feel, imagine or remember. In *Bolero* and *Lohengrin*, the number of drawn images was similar. However, in *Mix*, the number of images was statistically smaller. It could be that musical structure, the form of which the composer manipulates the musical elements, affects directly the listening experience and should be explored further. Although several images were related to the patients' personal memories, a thematic verification of the same reminds some archetypal images, verifying a collective conscience, therefore, in accordance with the "ISO" principle of music therapy<sup>25</sup> and of Jungian theory<sup>26</sup>. We can catch many things when listening music. Research was to investigate what effect an auditory subliminal message, produced by speeding up the rate at which was recorded, would have upon the imagery and dreams demonstrated a significant difference between the dream drawings and the imagery drawings of the experimental group and the control group. The results appear to indicate that the unconscious/preconscious mind is able to perceive a record verbal message that cannot be consciously understood<sup>16</sup>.

In the categories spirituality, maternal and life / death / regeneration / transformation, some objects came overlapped. The same drawn object was framed symbolically in more than one category. For example, maternal elements related to the source of life, which implicates a life / death process, going by the transformation associated to a spiritual character. Regarding the

archetypal approach, once only the archetype could be symbolically accessed, we could verify that two experiences symbolized by the patients could then be related by them: maternal and death, those experiences lived by all people of all races in accordance with Jungian theory and perhaps justifies its presence so much in the creation of the composer, as in the recreation of the listener.

The presented music, with smaller expressiveness in *Mix*, revealed a spiritual dimension, leading the patients to symbolically experiment the death concept, inside of a more pleasant climate, than what occurs daily when it occurs. This theme appeared under a new prism, characterized by its cyclic nature in the vital human process and associated to the beginning of individual life and to the possibilities of regeneration, purification and transformation.

The contact with symbols related to the maternal archetype might have led to the encounter of a presupposed request of help of one who suffers from chronic pain, providing a sensation of protection and comfort. This experience can be pain relieve associated.

The symbolic existence also permitted patients, besides contact with spirituality, a glimpse into a condition of totality and perfection, offering from a tenuous sensation of purity to one accentuated experience of centralization, leaving a tiny space to the symbolism of ones own imposed pain.

Under the therapeutic point of view, to which we offer the possibility of contact with a symbolic language that emerges from the unconscious, by way of music, we can be facilitating the part of a therapeutic process that is installed spontaneously in the individual reorganized in the same way that occurs with the aesthetic sensation.

For Jourdain<sup>27</sup> when we carry our own life situations to music, we can do what we want wi-

th them. Music idealizes as much positive emotion as negative. With that, it momentarily improves the emotional lives in the individual. Music serves to improve our reactions to the world, making them beautiful. There is abundant evidence that specific pieces or varieties of music evoke definite types of mood reactions. Not all listeners have the very same mood reactions to the same pieces but there is certainly a common or modal type of mood response, which is predictable for various pieces of music<sup>28</sup>.

The verbal reports on the mental images were quantitatively categorized into themes that associated to pleasure (well-being, nature, entertainment, relief of pain, movement, music, spirituality, memory), and to displeasure (discomfort, pain, sadness, death / loss, nostalgia), and in the absence of those associations they were considered as descriptive (images of the Middle Ages, the East, vagueness, contrast, militarism, reflections). The musical structure also seems to have acted so that it occurred, more the musical content, than what the composer wished to express and that it was recreated during the listening for each patient.

The category movement was characterized in *Bolero*, mainly for the dance and dancers in a connotation of show, related several times by the patients.

In *Lohengrin*, the references related to the category movement were less expressive as if they related more to "walk" than to "dance". What is emphasized in that piece are the images described related to sadness and death / loss, that was not expressively observed in Ravel or in *Mix*. Noted in the reports, the expression of death / loss, presented accompanied of sadness and of pain of those patients, however, in the symbolic field reflected in the drawings; death was presented covered by positive aspects of spirituality, in its cyclic context of regeneration and transformation, indicating another

possibility, suggesting as such, a compensatory mechanism. As for the descriptive images, those came more in *Mix*, which in general presented a number much inferior than the images drawn or related due to its structural presentation. These images configured categories of “vagueness”, “contrast”, and “irritation”. Ruptures without sense in harmony, in melody and in musical rhythm, or when those elements varied irresponsibly produce in the listener boredom, while the brain struggled to understand the patterns that were before it, confusing the nervous system<sup>27</sup>. The mental images-making experience was seemingly completely impaired in some patients while listening to the *Mix*.

Without a doubt, all of the images drawn or related had their genesis mediated by emotions only that in music those emotions seem to have another quality. For Vigotski<sup>29</sup> the emotion that a work of art communicates belongs to the field of aesthetic emotions differing from real emotions; for they represent an end in themselves and if they don't immediately manifest into a practical action they can, once accumulated and repeated, be redundant in substantial practical results. It doesn't contaminate many people with the feelings of an action, but it does have a transforming action.

The mental images are due to the aesthetic sensation that art produces. Music as art has been little explored in nursing works, probably for the reason that the used musical styles are extremely varied, and still have the question of musical preference that ends up guiding other considerations. We believed to have located, through the patients' experiences, a slope that deserves to be better explored by health professionals. As for the musical structure, it is suggested the influence of musical notes, *la* major and minor, as responsible for emotions considered respectively more posi-

ve and more negative<sup>30</sup>. However, this fact cannot be analyzed separately, using the music of Wagner as an example, the same being presented as *la* major, awakening in the patients feelings of sadness, loss and death, expressed as displeasing, but pain relief was observed. This suggests a catharsis process.

What the patients experienced during the listening of *Bolero* and *Lohengrin* inferred as much in the drawings as in the verbal reports, approached a re-equilibrium experience, reorganized, aspired for form, aspired for musical content, but also liberated, mainly in *Lohengrin*, in which feelings of displeasure could be subtly accessed and lived, which constitutes a therapeutic base in the handling of the human emotions. The symbolic experiences were similar in *Bolero* and *Lohengrin*, principally, but the aesthetic experience took different paths. In *Lohengrin*, opposites were reunited, generating therapeutic effects and in *Bolero*, pleasure predominated with therapeutic effects too.

### *Study limitation*

Caution is needed in interpreting the results of structure musical analyses and correlated mental images. This highlights the need for further replication of this study to fully evaluate the effectiveness this association. Others chronic pain patients must be included (i.e., cancer pain). Another limitation of this study was a three musical pieces sequential listening in the same session. The listening of the melodies in a row can have influenced the person to carry on particularly in on aspect of the subject experience of one of the specific melodies, what might have influenced the experience as a whole and even the execution of the drawings. The listening of each music piece accomplished separately may impede undesirable residual effects.

## Implications for nursing practice

Nurses should learn about the music therapy effects. They should also be taught how to teach patients to use music resources and when to recommend the use of music to patients. Improving the quality of life for patients experiencing pain is a goal for all nurse clinicians. The music intervention supply nurses with a potentially effective pain treatment modality, which may be utilized along with pain medication for effective pain management for musculoskeletal chronic pain. Further investigation about what types of mental images other melodies produce and what effects are observed. Research must be conducted to evaluate the effectiveness or to develop guidelines for clinical nursing practice.

## CONCLUSIONS

This study allowed us to observe that musical listening, mental images evoked and aesthetic/symbolic experience relationated favored the reduction of pain scores.

Significant differences emerged among *Bo-lero*, *Lohengrin* and *Mix*, verified through the base of elaborated drawings and aesthetic/symbolic different experiences observed. The musical structure seemingly is associated with music-therapeutic outcomes.

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