ROLE OF VIBRATION AND SOUND IN PHYSIOTHERAPY

Dott. Mariani Daniele Maria, Dott. Supplizi Marco, Dott. Irace Giuseppe, Dott. Barassi Giovanni

KEYWORDS: Music therapy, Vibro-acoustic stimulation, Vibration

ABSTRACT

In literature the therapeutic efficacy of the vibration applied to the human body is known and the rehabilitative therapeutic applications are multiple: ultrasounds, shock waves and focused mechanical-sound waves. Even music has recently been the subject of scientific evidence researches that gives investigate its ability to positively influence the psyche and the physical body. The benefits generated by music therapy are numerous and completely involve the individual in his bio-psycho-social aspect.

This single-blind randomized controlled clinical trial was carried out within the university rehabilitation and re-education centre venue of "Gabriele d'Annunzio" university, Chieti - Pescara.

The objective was to verify whether the immediate effects on the body of acoustic musical stimulation and acoustic vibrations are more effective than simple musical listening.

To achieve this goal, a Vibro-acoustic platform was used, a tool that allows the patient to listen to the sounds and the music and, at the same time, to perceive the vibration caused by the music itself thanks to the speaker on the whole body.

One hundred healthy subjects were randomly divided into two groups: the experimental group (SG) underwent both vibrational and acoustic stimulation (in a single therapeutic session), while the control group (CG) was subjected to a single session with non-functioning vibration platform and acoustic stimulation.

Vital parameters, mean body temperature variations using thermography, distribution of body fluids by bio impedance analysis, rheological parameters of occipital muscles, trapezius, erector of lumbar spine, gastrocnemius muscles, with the MyotonPRO System at T0 and T1 (previously and at the end of the protocol). Furthermore, a final questionnaire was administered aimed at evaluating the appreciation of the therapy and the perceived subjective perceptions.

As regards the statistically significant results, a general improvement in the parameters examined in the entire sample can be highlighted. Blood pressure in SG had a tendency to normalization. The CG has undergone an increase in the average body temperature (1.24%) and a decrease in body fluids (3.17%) greater than the SG.

In both groups, muscle tone decreased in all regions analysed, except in the lumbar region ones.

The same data found for muscle rigidity except for the lumbar region (CG increased by 0.75%). Better results in the analysis of the questionnaires were highlighted for the SG in which a greater satisfaction of the therapeutic sessions was perceived by the patient.

INTRODUCTION

The basis of vibroacoustic therapy was laid in the second half of the 20th century.

A low frequency sound (below 100Hz) in the audible range can produce mechanical vibrations that are different from the infrasonic frequencies (below 20 Hz) that are not audible to the human ear. (Hooper J., 2002)

By the term vibroacoustic therapy in literature is intended the sound-induced, low-frequency vibrations (not mechanical vibrations) mixed with music listening this kind of particular therapy could induce results also on the muscular system and in spasticity (Park C., 2017)

Vibroacoustic therapy uses low-frequency sinusoidal sound in the 30–120 Hz range supplemented by music for therapeutic purposes (Wigram T., 1996).

In the 1990, the physio acoustic method based on body scanning with a sinusoidal sound between 27–113 Hz and listening to specially selected music was developed by Lehtikoinen (Boyd-Brewer C.H., 2003). Other examples of vibro-acoustic devices include the multiple Eakin projects of Somatron Corporation released for the first time in 1985 (Tampa, Florida, USA), the musical vibration table (MVT) designed by Chesky in the late 1980s (Chesky K.S., 1991), HealBED first released in 1990–1991 (HealBED, Haapsalu, Estonia) (Rüütel E., 2018), Multivib

products (using a mattress or cushion with built-in vibrating speakers, Multivib as, Trondheim, Norway), developed Vibrobed in 2018 from Vilímek and Švarc (Vibroacoustic Brothers, Olomouc, Czech Republic), the Relaxation Lounge V1 and V2 of Nex Neuro Vibro-Acoustic Therapy (Kantor J., 2019).

Music therapy is safe and inexpensive and has been shown to improve the pain and anxiety associated with various diseases (Evans D., 2002, Nilsson U2008, Lee JH., 2016, Zhao K., 2016).

In terms of cancer-related pain in a perioperative context, music therapy helps alleviate pain, as noted by significant self-learning reductions in pain through Visual Analogue Scales (VAS) (Hole J., 2015).

Music therapy is also effective in reducing lumbar puncture pain (Nguyen T.N., 2010) and, among haemodialysis patients, music therapy helps alleviate headaches, chest pain and back pain resulting from the imbalance syndrome (Koca Kutlu A., 2014).

Furthermore, music therapy has proven effective in reducing pain in surgical blood vessel procedures, since this pain often results from anxiety about the procedure itself.

However, it seems that no previous study has examined the efficacy of music therapy on the neurovegetative system associated with vibro-acoustic stimulations on the whole body.

Since, no research had investigated these effects,

this randomized controlled trial would measure the efficacy of acoustic music therapy alone on neurovegetative and muscular rebalancing compared to association with acoustic vibrations produced by the music itself.

Many previous studies that evaluated the effectiveness of music used only one sound-free control group (Jenkins JS., 2001), which could produce a potential “placebo effect” for the intervention.

Moreover, some studies highlighted that the effects of music therapy vary in size from 26% to 58% and the average effect is 35% (Beecher HK., 1955, Kienle GS., 1997). In our research, trying to avoid the possibility of a placebo effect caused by the absence of an acoustic stimulus in the control group as for Jenkins JS., 2001 study, we decided to use in the “study” group acoustic vibration associated with the music itself while for the “control” group has been used only the acoustic music stimulus. This decision was taken a priori in the design of the study to better extract understand the true effect of music therapy.

Vibroacoustic therapy modalities have been described for the first time by the Norwegian therapist Olav Skille (Skille, 1989).

Our proposal for vibro-acoustic therapy uses sound to produce vibrations that are applied directly to the body. Only in one group the vibrations were used with music and the vibration frequencies were the background of the music composed to integrate the frequencies.

Music has been a means of therapy for centuries and there are numerous examples of the healing powers of music in historical recordings of different cultures (Wigram, 1995). In integrated vibro-acoustic therapy, the key is the combined effect of music and vibrations.

Materials and methods

1. Research Group

At the University Centre of Physiotherapy, Rehabilitation and Re-education of “Gabriele D’Annunzio” University - Chieti-Pescara, 100 healthy volunteers were recruited after the presentation of the experimental protocol and the signature of the informed consent for the study procedure.

The recruited sample was divided in two groups:

The experimental group (SG) underwent both vibrational and acoustic stimulation on the platform

(in a single therapeutic session),

While the control group (CG) was subjected to a single session with the platform turned off and acoustic stimulation of the music.

This subdivision took place through a process of randomization of the subjects using the “Truly Random 1.74” software.

It was decided to recruit healthy subjects for a preliminary analysis of the possible results obtainable through the execution of the protocol.

This choice was made to analyse the possible effects of the protocol first of all in the healthy population, to then better understand the therapeutic possibilities of the method.

The SG is composed of 25 male subjects and 25 female subjects, while the CG is composed of 34 male subjects and 16 female subjects.

The age of the 100 subjects varies from a minimum of 18 to a maximum of 39 years.

The sensory platform is a special wooden platform that transforms a digital audio track into sounds and vibrations.

It is made of plywood and its dimensions are: 120 cm, 180 cm wide in length and 15 cm of height.

Inside it there is a speaker system that represents the origin of the sound emission. The membrane of the vibrating speaker emits sound. The acoustic waves emitted by the speakers inside the platform are absorbed and transformed into vibrations, which are perceived by contact with the platform. Another part of the acoustic waves that passes through the wood, reaches the eardrum and is perceived as sound.

Therefore, the patient who comes into contact with the platform receives a double information: a vibrational stimulation and an acoustic one.

Consequently, the effects of the sensory platform on the organism are closely related to two components: physical effects related to vibration and psycho-emotional ones related to music or sounds in general. It is important to emphasize that this combination of effects, which are never separated from each other but influence each other, causes a unique and original result.

In addition to the sensory platform there are also two external speakers that emit the same music emitted by the platform.

The external speakers, positioned two meters from the device and in a mirror-like manner, have been added to increase the quality of the sound perceived by the ear and allow the differentiation of the sessions between the SG and the CG, that are subjected to listening only from external speakers.

2. Evaluation methods

Both the experimental group and the control group were evaluated at time T0 with the following instrumentation:

- Thermography
- bioimpedentiometry (BIA Anniversary 101)
- MyotonPRO system
- Electronic blood pressure monitor
- Oximeter

Using these instruments, vital signs (blood pressure, heart rate, respiratory rate, saturation),

The variation of the average surface body temperature, the distribution of liquids (intra and extra cellular), the rheological parameters of the sub-

Fig. 1 - Sensory Platform.

Fig. 2 - Scan with thermal camera (left), image and relative histogram of average temperatures (right).

occipital, trapezius, gastrocnemius and erector spine muscles were then evaluated.

The subjects underwent only one therapy session. Therefore, a total of 100 sessions were held, each lasting around 90 minutes.

The effective time of the sensory platform therapy is 30 minutes; the remaining time has been devoted to evaluations. At the end of each session the patients were re-evaluated at time T1 with the same initial assessments and a final questionnaire was administered.

The latter, consisting of a multiple-choice quiz and an open question, aimed to assess the satisfaction of the session and the subjective perceptions experienced. The order of the measurements taken at time T0, or before listening to the music on the platform, is different from the order of the measurements at time T1, or after listening.

The first instrument used was Myoton PRO, which made it possible to measure the rheological parameters of the following muscles:

Sub-occipital; two centimetres to the right and two to the left starting from C7 at the level of the trapezius muscle;

Two centimetres to the right and two to the left with respect to L3 at the level of the erector muscles of the column;

About 20 centimetres below the fold of the knee at the level of the gastrocnemius muscle.

The points were taken bilaterally and were marked with a dermatological marker to perform the measurement at time T1 at the same point, thus allowing a more reliable measurement.

The pulse oximeter was placed on the index finger of the right hand, measuring heart rate and oxygen saturation.

Meanwhile, pressure was measured by placing the electronic pulse meter on the wrist.

Subsequently, the plates were applied for the BIA scanning.

The plates were placed two in the right hand and two in the right foot; in particular, in correspondence of the third metatarsal and metacarpus and at the level of the fold of the wrist and ankle.

The tweezers of the electric cables have been applied to the plates, taking care to position the red tweezers on the distal plate and the black tweezers on the proximal one, taking care not to cross the cables, nor to make them form circles, to avoid forming an electromagnetic field which can disturb

the conduction of the cable itself and therefore the reliability of the measurement.

During the BIA scan the respiratory rate was measured, using a timer and counting the number of breaths performed in one minute.

The last measurement at T0 was performed with thermography.

It was positioned on a fixed support 30 centimetres from the platform, with an inclination of about 45°, so as to frame the patient from the upper part of the head to the pelvis, including the entire length of the upper limbs.

After performing the automatic temperature calibration and manual focusing of the subject, an indication was given to the patient to maintain the fixed position and the photo was taken.

In the room where the sessions took place, the humidity, measured with a hygrometer, fluctuated from a minimum of 29% to a maximum of 57%. So, it never exceeded 65%, a necessary condition to perform a thermal imaging scan under optimal conditions. The measurements at time T1, i.e. after the session to the music above, were made in this order:

- Scan with thermal camera
- Scan with BIA, detection of respiratory rate
- Detection of blood pressure
- Detection of heart rate and saturation
- Measurement with Myoton

At the end of these measurements, the questionnaire was completed and the session ended.

The order of the measurements is not random, but is designed to meet the needs of some instrumental evaluation methods

3. Treatment protocol

The healthy subjects who participated in the study were subjected to a protocol consisting of a single session, in which they listened to about 30 minutes of music on the platform.

We tried to stabilize the environment in which the experiments took place.

At the end of the measurements at time T0 the last indications were provided to the patient, the operator asked to the patient to close his/her eyes, the maintenance of the supine position and the attempt to relax and imagine.

The volume has been set and the playlist has been started, using the Windows Media Player program. The therapeutic playlist includes the following songs

1	How much did you like this experience?	A. anything	B. A little	C. Enough	D. much	E. extremely	
2	Has the breath changed during listening?	A. The frequency has increased, it has become faster	B. The frequency has decreased, it has become slower	C. It has not changed	D. I didn't notice And more	E. and more	_____
3	Has the heartbeat changed during listening?	A. The frequency has increased, the beats have become faster	B. The frequency has decreased, the beats are slowed down	C. It has not changed	D. I didn't notice And more	E. and more	
4	During listening did you feel a spontaneous change in how your body rested on the couch?	A. It became heavier	B. It has become lighter	C. A greater surface area of my body was placed on the platform	D. Nothing has changed	E. I didn't notice	F. Other
5	Has the perception of time changed during listening?	A. It has expanded, as if it were flowing more slowly	B. It has shrunk, as if it were flowing faster	C. It has not changed	D. I didn't notice	E. And more	
6	What has aroused the music heard?	A. Total relaxation, almost like helping me sleep	B. A sense of regeneration, relaxed but at the same time energetic	C. Total energy, almost as if it gave me the charge to run	D. Nothing	E. and more	_____
7	Has music given you memories?	A. Positive	B. Negatives	C. No memory	D. Other:	E. and more	_____
8	Did the music transmit them? (even more than one choice)	A. Cheerfulness B. Melancholy C. Hope D. Anger E. Fear F. Sadness G. Joy H. Disgust I. Anxiety J. Shame K. Carefree					

Fig. 3 - Questionnaire.

in the same order:

1. Sound of the sea - 3 min.
2. Pure Shores - All Saints - 4 min.
3. Tibet (A Passage To) - Buddha Bar - 5 min.
4. Weightless - Marconi Union - 8 min.
5. Airstream - Electra - 6 min.
6. Remember Me - Thomas Bergersen - 4.30 min.
7. Sound of the sea - 2 min.

The distinction between experimental group and control group exists only for a fundamental element: vibration.

Therefore, the variables set between the two groups are: assessments at the time T0 and T1, therapeutic

playlist, duration of the music, position of the patient on the platform, position and volume of the external speakers.

What substantially changes is the volume set on the platform, which is raised to the experimental group, while in the control group is lowered to zero so that there are only sounds and no vibration emitted by the sensory platform.

Music therapy alone is a therapy that can help in the healing process.

The music has been used in this research through a constant and stable rhythm, dynamic, fun, harmonious, regular, without sudden changes (Snyder L., 2014)

The instrumental music of “The Angels Gift” by Peter Sterling was one of the instrumental music of the harp, flute, violin and soft orchestral strings that could stabilize blood pressure after being administered for 25 minutes (Marabou K., 2015).
In the literature, no studies have been conducted that combine the change in muscle rheological parameters associated with music therapy.
Therefore, we were motivated to explore the immediate effect on muscles and autonomic functions.

4. Statistic analysis

A statistical analysis was performed using the NCSS

11 program, using the following method:
Non-parametric analysis, Wilcoxon Signed Rank test in paired T test procedures. The Excel 2016 program was used for data coordination and other analyses, such as averaging and percentage change.

RESULTS

The values of respiratory rate (HR) decreased in both groups, reaching optimal values and with a statistically significant T-Test examination value. It should be noted that the HR decreased more in the control group.
Below the results on the change in average body

Experimental Group	AP max.		PA min.		HR		RR		SpO2%	
	T0	T1	T0	T1	T0	T1	T0	T1	T0	T1
Mean	110,46	112,08	72,32	74,14	65,48	64,50	18,08	16,14	97,86	97,94
Δ %	1,46		2,51		-1,49		-9,29		0,08	
T-test	0,16		0,03		0,34		0,00		0,49	
SD	12,02	10,97	7,76	7,61	10,46	10,71	4,98	5,05	0,83	1,02

Tab. 1 - vital parameters in the experimental group: maximum arterial pressure (max. AP) and minimum (AP min.), Heart rate (HR) and respiratory rate (RR), oxygen saturation (SpO2%). First the session (T0) and immediately after the session (T1). SD: standard deviation.

Control Group	AP max.		PA min.		HR		RR		SpO2%	
	T0	T1	T0	T1	T0	T1	T0	T1	T0	T1
Mean	117,72	117,82	79,52	80,26	67,50	63,94	15,66	13,90	98,02	98,64
Δ %	0,08		0,93		-5,27		-11,23		0,63	
T-test	0,94		0,43		0,00		0,00		0,00	
SD	12,39	11,11	7,96	7,36	13,43	11,9	3,83	4,03	3,00	0,79

Tab. 2 - vital parameters in the control group: maximum arterial pressure (max. AP) and minimum (AP min.), Heart rate (HR) and respiratory rate (RR), oxygen saturation (SpO2%). First the session (T0) and immediately after the session (T1). SD: standard deviation

Fig. 4 - Heart rate change in the experimental group.

Fig. 5 - Average heart rate change in the control group.

Fig. 6 - Average TBW variation in the experimental group.

Fig. 7 - Average TBW variation in the control group.

Experimental Group	T°		TBW		ECW		ICW	
	T0	T1	T0	T1	T0	T1	T0	T1
Mean	32,47	32,53	39,06	38,63	16,69	16,41	22,38	22,19
Δ %	0,18		-1,11		-1,69		-0,82	
T-test	0,66		0,00		0,00		0,00	
SD	1,67	1,53	7,96	7,88	3,03	2,95	5,24	5,22

Tab. 3 - mean change in body temperature (T °), total liquids (TBW), extracellular fluids (ECW) and intracellular fluids (ICW) in the study group (SG). First the session (T0) and immediately after the session (T1). SD: standard deviation.

Control Group	T°		TBW		ECW		ICW	
	T0	T1	T0	T1	T0	T1	T0	T1
Mean	29,35	29,68	41,57	40,25	17,07	16,56	24,51	23,80
Δ %	1,24		-3,17		-2,98		-2,89	
T-test	0,02		0,02		0,04		0,02	
SD	0,82	0,93	8,73	8,22	3,22	2,74	5,84	5,65

Tab. 4 - average change in body temperature (T °), total fluids (TBW), extracellular fluids (ECW) and intracellular fluids (ICW) in the control group. First the session (T0) and immediately after the session (T1). SD: standard deviation.

temperature and on the distribution of liquids are highlighted.

The average body temperature has increased, in both groups, but to a greater range in the Control group. The variation of liquids indicates a decrease in TBW, ECW and ICW higher in the control group than in the experimental group. Both results are supported by significance of the T-Test. Percentage variation of tone in the cervical (C1), dorsal (C7), lumbar (L3) and gastrocnemius (GS) levels in the experimental and control group.

According to the results obtained, the elasticity increases in the cervical and lumbar region and decreases in the trapezius and gastrocnemius muscles.

Different variations of tone can be observed between the two hemisomes. Therefore, it is observed that the tone at the cervical level is decreased more in the left side of the body in the experimental group, while in the control group, in the right part.

Cervical elasticity increases more in the control

Experimental Group	C1		C7		L3		GS	
	T0	T1	T0	T1	T0	T1	T0	T1
Mean	14,76	14,45	13,60	13,24	13,68	13,75	14,75	14,38
SD	1,32	1,36	1,54	1,36	1,39	1,27	1,87	1,59
Δ %	-2,1		-2,6		0,5		-2,5	
T-test	0,00		0,00		0,22		0,00	

Tab. 5 - tone variation in the cervical (C1), dorsal (C7), lumbar (L3) and gastrocnemius muscle (SG) in the experimental group, before sitting down (T0) and immediately after doing so (T1).

Control Group	C1		C7		L3		GS	
	T0	T1	T0	T1	T0	T1	T0	T1
Mean	14,59	14,25	12,81	12,64	13,93	14,12	15,45	15,11
SD	1,44	1,44	1,34	1,39	1,53	1,40	1,90	1,80
Δ %	-2,3		-1,32		1,36		-2,2	
T-test	0,00		0,18		0,01		0,00	

Tab. 6 - tone variation in the cervical (C1), dorsal (C7), lumbar (L3) and gastrocnemius muscle (CG) in the control group, before sitting (T0) and immediately after doing so (T1). SD: standard deviation.

Fig. 8 - Change in the tone of the dorsal region in the experimental group.

Fig. 9 - Change in the tone of the dorsal region in the control group.

Experimental Group	C1		C7		L3		GS	
	T0	T1	T0	T1	T0	T1	T0	T1
Mean	1,13	1,11	1,03	1,05	0,98	0,97	1,24	1,34
SD	0,14	0,14	0,20	0,23	0,15	0,15	0,20	0,20
Δ %	-1,76		1,94		-1,02		8,06	
T-test	0,00		0,06		0,30		0,00	

Tab. 7 - variation of elasticity in the cervical (C1), dorsal (C7), lumbar (L3) and gastrocnemius muscle (SG) in the study group, before sitting (T0) and immediately after doing so (T1). SD: standard deviation.

Control Group	C1		C7		L3		GS	
	T0	T1	T0	T1	T0	T1	T0	T1
Mean	1,14	1,11	0,96	0,97	0,97	0,97	1,16	1,27
SD	0,14	0,13	0,20	0,25	0,18	0,19	0,17	0,18
Δ %	-2,63		1,04		0		9,48	
T-test	0,00		0,95		0,91		0,00	

Tab. 8 - variation of elasticity in the cervical (C1), dorsal (C7), lumbar (L3) and gastrocnemius muscle (CG) in the control group, before sitting (T0) and immediately after doing so (T1).

Fig. 10 - Variation of cervical elasticity in the experimental group.

Fig. 11 -Variation of elasticity at the cervical level in the control group.

Experimental Group	C1		C7		L3		GS	
	T0	T1	T0	T1	T0	T1	T0	T1
Mean	252,31	244,61	221,20	217,49	224,93	223,95	261,81	260,86
SD	51,40	50,29	37,31	33,36	54,35	54,04	40,26	30,74
Δ %	-3,05		-1,67		-0,43		-0,36	
T-test	0,01		0,06		0,65		0,67	

Tab. 9 - Variation of cervical stiffness (C1), dorsal (C7), lumbar (L3) and gastronemius muscle (SG) in the study group, before sitting (T0) and immediately after doing so (T1). SD: standard deviation .

Control Group	C1		C7		L3		GS	
	T0	T1	T0	T1	T0	T1	T0	T1
Mean	244,96	238,51	196,21	191,42	230,49	232,23	275,71	270,18
SD	47,64	46,50	35,19	33,59	58,43	58,03	39,90	35,85
Δ %	-2,63		-2,44		0,75		-2	
T-test	0,06		0,06		0,51		0,00	

Tab. 10 -Variation of cervical stiffness (C1), dorsal (C7), lumbar (L3) and gastrocnemius muscle (CG) in the control group, before sitting (T0) and immediately after doing so (T1). SD: standard deviation.

group than in the experimental group, while at the level of the gastro soleus muscle, it decreases up to 8% in the experimental group and more than 9% in the control group. Both of these values are supported by the significance of the T-test.

Regarding the questionnaire, the results obtained provide a measure of the satisfaction of the session and a subjective evaluation of each participant on the emotional and physical perceptions experienced during the session.

The participants in the experimental group reported at the end of the session a sense of regeneration, which, as specified in the questionnaire, means a sense of relaxation and at the same time energy. While the participants in the control group mostly reported only a relaxation, which, as defined in the questionnaire, means a general distension that probably leads to a state of drowsiness. The perception of time was different in the two groups. The experimental group

highlighted an expanded perception of time, like if it was flowed more slowly. While the control group reported the opposite, that it was flowed faster.

The results of the questionnaires were more favourable for the experimental group in which, not only a greater satisfaction of the session was found, but also, as regards the answers to the open question, a richer and more variable repertoire of answers. Also, the perception of regeneration and the feeling of hope, apparently of little importance, which in a long-term perspective for patients suffering from chronic pathologies associated with anxiety or depression disorders could be a treatment to propose, could be underlined.

DISCUSSION

Based on the results obtained it can be observed that there was a general improvement in the parameters examined in both sample groups.

Fig. 12 -Variation of elasticity at the level of the gastrocnemius muscle in the experimental group.

Fig. 13 -Variation of elasticity at the level of the gastrocnemius muscle in the control group.

Arterial pressure changed in both groups. However, in the experimental group a convergent trend of pressure changes was observed, in which the values of the maximum BP approached 110 mmHg and the values of the minimum at 80 mmHg.

It could be argued that the pressure tends to normalize, tendentially already with one session.

This result, combined with the decrease in heart and respiratory frequencies in both groups, suggests that the value of cardiac output and, consequently, of cardiovascular performance has increased.

Acute changes in body temperature and the distribution of total, intracellular and extracellular fluids favoured the control group.

Indeed, this group (without vibration) showed an increase in average surface body temperature and a decrease in body fluids greater than in the experimental group.

As for the rheological parameters of the muscles, a different tendency between the regions that have been in greater contact with the surface of the platform, the dorsal kyphosis and the gastrocnemius muscle, and those that have had less contact with it, cervical lordosis and lordosis lumbar, could be noted.

It is to underline that in both groups the tone decreased in all regions except for the lumbar region.

In dorsal kyphosis and in gastrocnemius muscle, the tone obtained better results in the experimental group, demonstrating a relaxation induced by the stimulation of the tissues with the vibration.

Elasticity is increased more in the lordosis regions,

but without showing a marked difference between the two research groups.

Muscle stiffness is reduced in all regions and in both groups. Moreover, in the lumbar region, the rigidity is increased in the control group.

Finally, the results of the questionnaires were more favourable for the experimental group in which not only a greater satisfaction for the session was achieved, but also, with regard to the answers to the open question, a richer and more variable repertoire of answers was showed.

Researches have suggested that music alone could inhibit and balance brain information, which can trigger the limbic system related to emotions. The limbic system was probably activated and the individual felt relaxed.

Vibration-associated music could influence sympathetic system activities that play a role in catecholamine plasma concentrations and also influence the release of stress-released hormones and stimulate the body to produce nitric oxide molecules that acts on the tone of blood vessels to reduce blood pressure (Astuti NF, 2019).

Finally, the perception of regeneration and the feeling of hope, apparently of little importance, but that in a long-term perspective for patients suffering from chronic pathologies associated with anxiety disorders or depression could be an important discovery that could be fruitful not only in rehabilitation but also in other medical and para medical fields.

REFERENCES

1. Astuti NF, Rekwati E, &Wati DNK.(2019)Decreased blood pressure among community dwelling older adults following progressive muscle relaxation and music therapy (RESIK).BMC Nurs. Aug 16;18 (Suppl 1):36. doi: 10.1186/s12912-019-0357-8
2. Beecher HK. (1955).The powerful placebo. J Am Med Assoc.;159:1602–6.
3. Boyd-Brewer C.H. (2003). Vibroacoustic Therapy: Sound Vibrations in Medicine. Altern. Complement. Ther. :9. doi: 10.1089/107628003322490706.
4. Cantekin I, &Tan M.(2013). The influence of music therapy on perceived stressors and anxiety levels of haemodialysis patients. Ren Fail.;35:105–9.

5. Chesky K.S., & Michel D.E. (1991). The Music Vibration Table (MVT): Developing a Technology and Conceptual Model for Pain Relief. *Music Ther. Perspect.*;9:32–38. doi: 10.1093/mt/9.1.32.
6. Evans D. (2002). The effectiveness of music as an intervention for hospital patients: a systematic review. *J Adv Nurs.*;37:8–18.
7. Hole J, Hirsch M, Ball E, & Meads C. (2015). Music as an aid for postoperative recovery in adults: a systematic review and meta-analysis. *Lancet.*;386(10004):1659–71.
8. Hooper J. (2002). Is VA therapy, music therapy? *Music Ther. Today.*;2:24.
9. Jenkins JS. (2001). The Mozart effect. *J R Soc Med.*;94:170–2.
10. Kantor J, Kantorová L, Marečková J, Peng D, & Vilímek Z. (2019). Potential of Vibroacoustic Therapy in Persons with Cerebral Palsy: An Advanced Narrative Review. *Int J Environ Res Public Health*. Oct 16;16(20). pii: E3940. doi: 10.3390/ijerph16203940. Review
11. Kienle GS, & Kiene H. (1997). The powerful placebo effect: fact or fiction? *J Clin Epidemiol.*;50:1311–8.
12. Kim Y, Evangelista LS, Park YG. Anxiolytic Effects of Music Interventions in Patients Receiving Incenter Hemodialysis: A Systematic Review and Meta-Analysis. *Nephrol Nurs J*. 2015;42:339–47 quiz 348.
13. Koca Kutlu A, & Eren AG. (2014). Effects of music on complications during hemodialysis for chronic renal failure patients. *Hemodial Int.*;18:777–84.
14. Lee JH. (2016). The Effects of Music on Pain: A Meta-Analysis. *J Music Ther.*;53:430–77.
15. Lin YJ, Lu KC, Chen CM, & Chang CC. (2012). The effects of music as therapy on the overall well-being of elderly patients on maintenance hemodialysis. *Biol Res Nurs.*;14:277–85.
16. Lindquist S. & Tracy S. (2014). *Complementary & Alternative Therapies in Nursing*. 7th Edn. Springer Publishing Company;.
17. Merakou K., Varouxli G., Barbouni A., Antoniadou E., Karageorgos G., Theodoridis D., Koutsouri A., & Kourea-Kremastinou J. (2015) Blood Pressure and Heart Rate Alterations through Music in Patients Undergoing Cataract Surgery in Greece. *Ophthalmology and Eye Diseases.*;7:OED.S20960. doi: 10.4137/OED.S20960.
18. Nguyen T.N., Nilsson S., Hellström A.L., & Bengtson A. (2010). Music Therapy to Reduce Pain and Anxiety in Children With Cancer Undergoing Lumbar Puncture: A Randomized Clinical Trial. *Journal of Pediatric Oncology Nursing* 27; 146
19. Nilsson U (2008). The anxiety- and pain-reducing effects of music interventions: a systematic review. *AORN J.*;87:780–807.
20. Park C., Park E.S., Choi J.Y., Cho Y., & Rha D.-W. (2017) Immediate Effect of a Single Session of Whole Body Vibration on Spasticity in Children with Cerebral Palsy. *Ann. Rehabil. Med.*;41:273–278. doi: 10.5535/arm.2017.41.2.273
21. Pothoulaki M, Macdonald RA, Flowers P, Stamataki E, Filiopoulos V, Stamatiadis D, et al. (2008). An investigation of the effects of music on anxiety and pain perception in patients undergoing haemodialysis treatment. *J Health Psychol.*;13:912–20.
22. Rüütel E., Vinkel I., & Laanetu M. (2018). Vibroacoustic Therapy and Development of a New Device: A Pilot Study in the Health Resort Environment. *Univers. J. Public Health.*;6:240–246. doi: 10.13189/ujph.2018.060502.
23. Skille O. (1989). VibroAcoustic therapy. *Music Therapy*, 8, 61–77. 10.1093/mt/8.1.61
24. Wigram A. L. (1995). The effects of vibroacoustic therapy on clinical and non-clinical populations. Gordon, Reading, UK: Harwood Academic Publications.
25. Wigram T. (1996) Thesis. London University; London, UK: The Effects of Vibroacoustic Therapy on Clinical and Non-Clinical Populations.
26. Zhao K, Bai ZG, Bo A, & Chi I. (2016). A systematic review and meta-analysis of music therapy for the older adults with depression. *Int J Geriatr Psychiatry.*;31:1188–98.