

THE OPTIMIZATION OF KINETIC TREATMENT IN THE RHEUMATIC DISEASES OF THE DORSAL SPINE BY USING MECHANIC VIBRATIONS OF LOW AND MEDIUM FREQUENCY

OPTIMIZAREA TRATAMENTULUI KINETIC ÎN AFECȚIUNILE REUMATICE ALE COLOANEI VERTEBRALE DORSALE PRIN UTILIZAREA VIBRAȚIILOR MECANICE DE JOASĂ ȘI MEDIE FRECVENȚĂ

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Key words: rheumatic disease, mechanic vibration, spine mobility, physical therapy

Abstract: This thesis aims to study the effect of mechanical vibrations over the articulations between two vertebral bodies that are placed next to each other in order for the intervertebral disc to function better, for improving its physiology, for improving its form and height, positively contributing to the spine's statics and dynamics. The effect of mechanical vibrations over this unique structure of the locomotor apparatus is known and signaled by the Health Service as a malignant factor, for protecting the operators who work on machines that produce vibrations of different frequencies and amplitudes. However the possible positive effects that could be gained by controlling and modulating rigorously their parameters are not yet known. If we start by getting to know the effects of vibrations (trepidations) and controlling rigorously their parameters one can estimate that the mechanical vibrations can have a valuable therapeutic effect.

Cuvinte cheie: afecțiuni reumatice, vibrații mecanice, mobilitatea coloanei, kinetoterapie

Rezumat: Scopul acestei lucrări este de a studia efectul vibrațiilor mecanice asupra articulațiilor intervertebrale alăturate, pentru o mai bună funcționalitate a acestora, pentru îmbunătățirea fiziologiei, a formei și înălțimii, contribuind astfel la îmbunătățirea staticii și dinamicii vertebrale. Efectul vibrațiilor mecanice asupra acestei structuri unice a aparatului locomotor este cunoscut sub denumirea de factor malignizant, pentru protecția celor care lucrează pe mașini ce produc vibrații de diverse frecvențe și amplitudini. Posibilele efecte pozitive ce pot fi obținute prin controlul și modularea acestor parametri nu sunt cunoscute încă. Dacă se va începe prin cunoașterea efectelor vibrațiilor (trepidațiilor) și prin controlul riguros al parametrilor acestora, se poate estima valoarea terapeutică a acestora.

Introduction

Contemporary life and its increasing requirements in all fields of activity claims a constant concern for finding all scientific and technological ways of increasing the efficiency and optimizing both the methods and techniques used in achieving our goals and in the decision making process, which is always according to the present needs and demands. Regaining the health of the human body with its different systems has always been a constant concern of human beings along history.

The use of the benefic action of physical exercises in different diseases, the deliberate use of environmental factors, of natural remedies has always been among the main concerns of scientists: doctors, pharmacists, biologists, chemists, physicists, physical therapists, etc. Physical therapy, in

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order to become even more effective, can use alternative methods in order to improve the therapeutic process. Until now this has been accomplished by using methods such as: massage, elongations, pressopuncture, thermotherapy or cryotherapy, electrotherapy, mechanical vibrations, shock waves etc. About mechanical vibrations one can state that their benefic effects are known just over muscles (relaxation and tonification), over the bones in treating osteoporosis, over some bronchopulmonary diseases (drainage) and over the blood flow.

The studies continue at the level of these anatomo-functional structures because by modulating the parameters one can obtain marvelous effects. This thesis aims to study the effect of mechanical vibrations over the articulations between two vertebral bodies that are placed next to each other in order for the intervertebral disc to function better, for improving its physiology, for improving its form and height, positively contributing to the spine's statics and dynamics. The effect of mechanical vibrations over this unique structure of the locomotor apparatus is known and signaled by the Health Service as a malignant factor, for protecting the operators who work on machines that produce vibrations of different frequencies and amplitudes. However the possible positive effects that could be gained by controlling and modulating rigorously their parameters are not yet known. If we start by getting to know the effects of vibrations (trepidations) and controlling rigorously their parameters one can estimate that the mechanical vibrations can have a valuable therapeutic effect.

Studying their effects we considered that these could be an efficient means in a wide kinetic strategy together with other associated means already known and appreciated. We have had the example of cervical and lumbar elongations at the level of the spine, resembling to stretching, i.e. kinetic procedures. We have noticed that these elongations would improve, sometimes a lot, the effect of the kinetic treatment.

Our personal opinion is that by associating the mechanical vibrations to physical therapy we can obtain positive results, comparable, by effect, with the one of elongations, which are successfully applied in the lumbar and cervical areas. The research theme that we set to do is:

THE OPTIMIZATION OF KINETIC TREATMENT IN THE RHEUMATIC DISEASES OF THE DORSAL SPINE BY USING MECHANICAL VIBRATIONS OF LOW AND MEDIUM FREQUENCY. We manifested a special interest in this matter starting with 1989. We wanted to emphasize the value of mechanical vibrations at the level of the intervertebral disc with the purpose of slowing the process of its deterioration and obtaining the remodeling of its shape, height and functions.

The degenerative rheumatic diseases are almost always installed in one or more soft or hard tissues of the spine. Considering that the state of attrition of these tissues is the main cause of the majority of spinal diseases we thought that a study on this theme would be welcome by putting to use the professional experience that we have acquired both in the kinetic treatment of the spine and in applying therapy by using elongations at the level of the cervical or lumbar segments of the spine (with a deliberate effect on the intervertebral disc). We considered that for this kind of scientific and experimental research a deep knowledge of anatomy and physiology of the spine is also necessary because the installation of the dysfunctions and of the pathology by degeneration of its structures cannot be made objectively unless we report it to its normal state. We have registered the various degenerative forms and their causes, the diseases they generate and the therapeutic strategy which can be applied to improve health and the quality of life for these patients. We have done an incursion into the various forms of evaluation of the spine, indicating the objectives of the kinetic treatment that can be performed. This thesis being at the interference between two scientific areas, physics and medicine (physical therapy), apparently with no common ground we have also included a theoretic study on vibrations (trepidations) in order to know better the characteristics of various types of vibrations, especially the mechanic ones for exploiting them therapeutically. We have had a special concern for the studies and recommendations of the Health Service which signals the

malignancy of mechanical vibrations. We deducted the causes and the possible perils over the human body and also the technical and legislative measures that are implied.

The requisites of research start from:

- 1) knowledge of the anatomo-functional and biomechanics of the spine in general and of the motor segment in particular;
- 2) the pathology of the spine in general and of the disc in particular (causes and effects);
- 3) professional requisites or the practical application of our professional experience of over 20 years in this field with special emphasis on a methodic and didactic approach of the physical therapy sessions.

Hypothesis

The hypotheses of our work are:

- The mechanical vibrations of low and medium frequency can contribute to the remodeling of the shape and height of the intervertebral disc with possible positive effects in the treatment of degenerative rheumatic diseases of the dorsal spine, equal or superior to other procedures.
- This kind of vibrations, although they are considered malignant by the Health Service (because of long term exposure) in the conditions of rigorous control of their parameters: frequency, duration and amplitude = force, can have therapeutical value in the complex treatment of the degenerative rheumatic diseases of the dorsal spine.
- By associating mechanical vibrations of low and medium frequency to the kinetic treatment one may obtain superior results by comparison to the kinetic treatment alone. The vibrations contribute to the improvement of functional indices and parameters, to the relief of pain or discomfort, to the reduction of the treatment time.

Research objectives

The use of mechanical vibrations of low and medium frequency in the kinetic treatment of back pain, in an experimental way as an associated means to obtain better results in treating this disease; - the construction of a machine which produces mechanical vibrations to correspond the limits of use for vibrations with low and medium frequencies with a possibility to adjust the parameters: exposure time, force=amplitude (intensity), frequency, application method; - the determination of the functioning limits of the mechanical vibrations' parameters with a therapeutic purpose and circumscribing these from some possible negative effects; - the knowledge and application of all the regulations concerning the use of medical installations in order to protect the patients and the operators during the activity of the machine; - the determination of the collaboration protocol with the management of the Clinical Hospital of Rehabilitation in Băile Felix concerning the use of the machine and determining the collaboration protocol with the patients who take part of the experiment; - the collaboration with the physical therapists in the mentioned location.

The stages of research:

The stages of research are the determination of the research period; - the selection of the lot undergoing the research by criteria of age, sex, diagnosis; - informing the patients regarding the rights, advantages and possible disadvantages of their participation to the experiment; - submitting the patients to the experiment and gathering data; - the chart completed by the doctor and the physical therapist; - the filling of the tables; - processing the data.

The Physiotherapy of Dorsal Arthrosis. The Dorsal Arthrosis as a degenerative rheumatic disease of the spine poses some special problems from a kinetic point of view because the ribs are attached to the 12 vertebrae of this segment protecting the chest in which the vital organs are housed.

Mobility between two adjacent vertebral bodies of the thoracic segment is smaller by comparison to the mobility between two vertebral bodies at the other mobile segments of the spine. The objectives of the kinetic treatment can only be met with the same efficiency regarding these peculiarities. It is important for the physical therapist to have a thorough theoretical training in this respect blended with a rich practical experience in applying the exercises, the techniques and the kinetic methods according to the known principles of teaching from The Methodology of Physical Education and Sports.

Treatment method for degenerative rheumatic diseases of the dorsal spine disc by means of vibrations of low and medium frequency

In this paper we wanted to associate to the kinetic treatment mechanical vibrations of low and medium frequency in the degenerative rheumatic diseases of the dorsal spine originating in the disk. The patient's position during exposure to vibrations was supine with the dorsal segment over the three vibrating segments, with the hips and knees bent, feet on the bed surface, back muscles relaxed. **Patient size** and **the parameter finger-ground** (which expresses the functional status of the spine and highlights some of its dysfunctions related to mobility) were measured at admission and at discharge (10 days of treatment) because these parameters express the overall effect of treatment regardless of its type. To highlight the effect of treatment in a comparative manner between the two types of separate treatment, we have taken into consideration several somatoscopical and anatomico-functional parameters. These parameters are: the spine's length measured in mm, spirometry (vital capacity), expressed in cm³, chest elasticity, expressed in cm, the assessment of pain or discomfort expressed on an Analog scale in percentages. Tracked data were entered in tables 1-8. **The spine's length, spirometry = vital capacity**, expressed in cm³, **chest elasticity, pain and / or discomfort** were measured before and after the kinetic treatment and also before and after the treatment with vibrations. These measurements were made within 5 days before and after the kinetic treatment and in the following five days before and after the vibration treatment, followed by the kinetic treatments. In other words the kinetic treatments were made on all 10 days of treatment, in the first five days, only kinetic treatments and over the next five days vibrations were introduced, measured before and after exposure, followed by the kinetic treatment. Afterwards we proceeded to comparing each parameter separately; of the kinetic treatment and of the vibration therapy, then we highlighted the results. Afterwards comparisons were made between sexes in the same age category and between different age groups to the same sex.

Vibration parameters: - **frequency** expressed in Hz is between 1 and 30 Hz; - Power of the vibrations = **amplitude**, expressed in percentages and - **time of exposure** to vibrations was no less than 8 minutes and no more than 12.

The analysis and interpretation of results highlights the following results: **size** increases by approximately as many mm as the dorsal spine elongates under the combined influence of kinetic treatment with vibrations. The gained millimeters do not persist for a long time, however, are beneficial and relevant to treatment effectiveness as they express the restoration of the disc's height and shape, treat pain and contribute to the installation of a state of comfort; **the parameter finger-ground** "is also much improved under the combined influence of the two types of treatment, expressing a gain in mobility and even a temporary return to a state of normality. The other indices increase as follows: **The spine's length** is increased by treatment with vibrations about 3-4 times more than just by kinetic treatment; **Spirometry** (vital capacity) is improved by treatment with vibrations about 3 times more than by kinetic treatment alone and the chest elasticity about 2 times more.

Patients in groups of 18 to 29 years of age, respond better to the combined action of the two forms of treatment than older patients, the groups of 30-60 years of age. **The pain and / or**

discomfort drop dramatically under the influence of vibrations while under the influence of kinetic treatment alone drop little or not at all. This is plausible because by an exposure to vibrations of about 12 minutes muscle relaxation is produced, which leads to a decrease in pain or discomfort.

Conclusions

1) The kinetic treatment of degenerative rheumatic forms of the dorsal spine, on a range of 10 to 12 days of treatment, in a hospitalized or ambulatory regime in hospitals or spa clinics, can benefit significantly higher results by the intake of low and medium frequency mechanical vibrations, these proving to have therapeutic value in such diseases.

2) The application of mechanical vibrations on the dorsal spine when discharged and relaxed contributes substantially to the restoration of the disc's shape and height. This is the cause of the vast majority of the spine's degenerative diseases and is the only anatomic-functional part which can modify its shape and volume under the influence of vibrations.

3) The dorsal spine's exposure to mechanical vibrations in the conditions of strict control of their parameters is not harmful.

4) Patients accept and cooperate with interest to this new form of treatment (decreases the pain or discomfort).

5) Comparatively, in 2 x 5 days of treatment with vibrations applied experimentally to the same group of patients with different forms of Dorsal Arthrosis, who were doing kinetic treatment over 10 days, in the second period of treatment (with vibrations) a significant increase in the dorsal spine was found; the contribution of vibrations being 3-4 times higher than that of simple kinetic treatment.

6) The increase (elongation) of the spine by restoring the shape and height of the intervertebral disc under the influence of vibrations results in reducing the pain or discomfort due to the restoration within normal limits of the conjugation hole through which spinal nerves exit and thus the functional indices are improved.

7) Young patients, of 18-29 years of age, males or females, with early disc diseases, recorded significantly better results, which entitles us to consider that the vibrations have a better therapeutic effect compared to their effects on older people, of 30-60 years of age who are more moderate in their responses to vibrations and gain less in height, the intervertebral disc being more damaged, which can be seen from the diagnosis. Regarding pain and discomfort relief, and better functional indices we discovered that there were no significant differences to the younger people.

8) The influence of vibrations occurs with the same efficiency on the costovertebral joints as well; the gain in mobility is proportional to the elongation of the spine. This can be seen from the increase in vital capacity and thoracic elasticity, parallel to the elongation of the spine.

9) The gain recorded in the assessment of thoracic elasticity and vital capacity is illustrative, confirming their positive effect and sustain the possibility of their combination with the kinetic treatment.

10) The functional mobility parameter "finger – ground is significantly improved in the overall context of treatment, particularly by kinetic treatment and less significantly by vibrations.

11) By inducing relaxation in the paravertebral muscle by improving local blood circulation, by decreasing pain and by improving comfort, by superior results in functional indices, mechanical vibrations have an important contribution to the optimization of kinetic treatment. After the treatment with vibrations patients declared on many occasions "I need to sit straighter".

12) The most effective and the best liked frequencies proved to be those between 4-8 Hz (x 2 or x 3, depending on how many segments were activated).

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