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Original article

KINESIOTHERAPY'S ROLE IN THE TREATMENT AND PROPHYLAXIS OF OSTEOPOROSIS

FIEROIU Emil¹

Abstract*

Aim. Osteoporosis is one of the major diseases of modern age, dependent on a certain lifestyle (diet, lack of exercise). It is currently deemed to be one of the most important diseases affecting the human race, before hypertension and diabetes mellitus. The disease begins manifesting several years after onset. The sooner it is tracked down, the better fractures can be prevented.

Osteoporosis may mean long periods of pain, deformities causing infirmity due to bone breaking or crushing or even the eventuality of premature death. Thanks to the longevity nowadays and to the increase in the number of people exceeding the age of 60 years old (persons predisposed to osteoporosis), the number of those suffering from this disease is continuously ascending.

The work aims to demonstrate that the prophylactic kinetic programme proposed contributed to improvement of the quality of life in patients with osteoporosis.

Methods. Literature analysis method, Investigation method, Observation method, Case study method

Results. To influence the algesic symptomatology caused by degenerative injuries of the spine using a complex methodology (orthotic service, medication therapy and physical-kinetic therapy).

To educate patients with regard to the right posture, avoiding the lordosing static positions or prolonged kyphosing positions, as well as teaching them the right way to lift weights so as to protect the spine.

Conclusions. Kinesiotherapy is an instrumental means to osteoporosis prophylaxis. Osteoporosis pathogenicity is complex and multi-factorial, alteration of the bone mass density being just the end common way whereby pathological factors affect the risk for future osteoporotic fractures.

Keywords: osteoporosis, kinesiotherapy, prophylaxis, skeletal system.

Introduction

As life expectancy is increasing, and the number of inhabitants around the globe is as well, age-related diseases also increase! It is estimated, by official data provided by the WHO, that by the age of 50 years, approximately one woman out of three, after the age of 70 years, one man out of seven is most likely to suffer a fracture due to osteoporosis (Drăgan, 2006).

"Persons descending from Black African people, especially men are the most resilient to osteoporosis and Asian men are the next lucky persons" (Gomez, 2008).

Osteoporosis is one of the major diseases of modern age, dependent on a certain lifestyle (diet, lack of exercise). It is currently deemed to be one of the most important diseases affecting the human race, before hypertension and diabetes mellitus (Pluteu, 2011).

Osteoporosis is a diffuse disease of the skeleton featuring decreased bone mass, alterations of

bone micro architecture leading to a decrease in muscle strength's resistance and to the occurrence of fractures. It is also called "the silent epidemic". It manifests by fracture occurrence. The osteoporotic regions are: the spine, hip and radio carpal joint. Morbidity caused by osteoporotic fractures represents 30% of the total osteoarticular injuries, and mortality reaches 12-20%. Osteoporosis may be due to: a) hereditary factor; b) poor nutrition in childhood and adolescence; c) sedentary life; d) menopause; e) excess consumption of alcohol, coffee and tobacco smoking (Marcu, 2006).

Osteoporosis is most often silent, fracture being the first manifestation of this disease. Fractures occurred by vertebral compaction are caused by minimum effort (cough, sneeze). Pain onsets acutely, but gradually decreases in intensity over the course of the following weeks and it is more enhanced in upright posture. Hip fractures occur following a fall from the same level. Spine deformations may also be noticed, associating dorsal kyphosis to cervical

¹Health Care and Kinesiotherapy Department, University of Pitesti, ROMANIA

E-mail address: fiero_emilius@yahoo.com

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lordosis and height decrease (Niculescu, 2014).

The locomotor system is made up of bones with their connections, joints and muscles. The totality of bone structures form the skeleton; bones are interconnected by conjunctive structures of various types, which ensure their mobility, i.e. the possibility to move in relation to others (Papilian, 2010).

By their hardness and resilience, bones contribute to determining the shape of the body and they are the support of soft tissues. They form protective cavities, in which organs are housed, for instance: the cranial box, vertebral canal, thoracic cavity and osseous basin. They are movement organs because they take part in the formation of joints and give insertions to the muscles.

The bone is a haematopoietic organ by its red marrow in the long and wide bones. By their mineral component, bones constitute a deposit of phosphocalcic substances, which the body may mobilize when necessary.

The bone growth process takes place in length and thickness. The increase in length takes place on the level of growth (metaphysis) cartilage by endochondral ossification.

Bone increase is influenced by endocrine factors and vitamins; this is how the hypophyseal growth hormone, parathyroid and thyroid hormones, as well as sexual hormones intervene. Alongside with hormones, there are also vitamins A, B and especially vitamin D, favoring calcium absorption in the bones (Ispas, 2000).

Bone hardness and rigidity is due to the presence of mineral salts, among which Calcium-phosphorus complex is central. Flexibility is ensured by the collagen fibers. Apart from these, water is also in bones' composition (5%) and cells which ensure bones' continuous remodeling: *osteoclasts* – responsible for bone resorption – and *osteoblasts* – cells responsible for bone reconstruction. Kinesiotherapy is an important component of prophylaxis and treatment. The great truth is that, in order to be maintained, the bone has to be used. There are numerous studies showing that the level of bone charging has a positive impact on the bone increase and remodeling (Popescu, 2002).

Hypotheses

1. The work proposes to prove that the prophylactic kinetic programme proposed contributes to the improvement of the quality of life in patients with osteoporosis.
2. Complete clinical assessment of persons with osteoporosis, in the context of appreciating the clinical and general

functional status of the patient contributes to the more effective recovery of the patient.

Methods

The documents I've studied, written by Romanian and foreign authors, classified by bibliographical criteria, have been divided into primary scientific documents, among which mention must be made of: handbooks, reference books, monographies, scientific reports, periodical press (magazine and newspapers), works presented at scientific manifestations, corpora of scientific communications, dissertations and scientific secondary documents, i.e.: synthesis studies, reports magazine, indexes (of names, authors of subjects), catalogues (theme, by subjects), bibliographies, dictionaries (explanatory, of literary or specialized terms).

Investigation method

I have used this method for this paper in order to get a large volume of information within a short time-frame with regard to the locomotor system and the occurrence of osteoporosis.

Observation method

In the case of our research, observation consists of the careful, intentional monitoring and exact, systematic registration of the various manifestations of the persons with osteoporosis, as well as the situational context where it occurs, so as to notice essential aspects of this disease's manifestation.

Case study method:

In this work we've studied two cases of patients with osteoporosis whose progress over the course of training was monitored and whose results were set in order and compared to one another.

Experiment's carry out

Patients diagnosed with osteoporosis were included in the study for which data was available and for which complete clinical – functional data could be obtained at the time of the study as per the study objectives;

I have selected the patients who were subjected to the experiment from "Casa Sperantei" (*house of Hope*) Nursing Facility to have been diagnosed with osteoporosis.

I judged, within the clinical assessment, the general health status (by systems and functions, especially the cardiovascular function – blood pressure, heart rate, peripheral pulse, status of peripheral, respiratory, digestive and neurological vessels).

Presentation of experimental cases

The experimental cases investigated in this study are in a number of 2, consisting of females aged 65 and 67 years. The environment in which the subjects live is urban. The rehabilitative programs instituted were personalized depending on each patient's diagnosis and characteristics.

The patients underwent 5 sessions per week with a variable duration between 15-30 minutes, increasing the individual recovery programs weekly by increasing the number of repetitions or enhancing the weight depending on the stage, seriousness and progress of each subject's diagnosis. The existent organizational setting, as well as active and aware participation of subjects facilitated the carry out under proper conditions of the experiment proposed for research.

Kinesiotherapy objectives with regard to osteoporosis

- To influence the algesic symptomatology caused by degenerative injuries of the spine using a complex methodology (orthotic service, medication therapy and physical-kinetic therapy).
- To educate patients with regard to the right posture, avoiding the lordosing static positions or prolonged kyphosing positions, as well as teaching them the right way to lift weights so as to protect the spine.
- To educate patients with regard to the risks of falls and fractures by preparing personalized programs to enhance stability, comprising exercises to build muscle strength.
- To prevent fractures from occurring by influencing the risk of fall, caused by coordination and balance deficiencies, poor eyesight, muscular hypotonia, confusion and medication consumption which cause arterial hypotension as a side effect or sensory sense alteration.
- Reducing the ineffective rest periods.

The kinetic programme was composed of:

Postural re-education exercises:

a. Re-educating rest posture

b. Re-educating gait posture

Stretching exercises

A. Stretching exercises for torso

- Exercises for toning the cervical- dorso-lumbar muscles and the abdomen.
- Exercises for toning the cervical muscles and shoulders.
- Exercises for improving the thoracic posture
- Exercise for toning the brachial triceps and the muscles on shoulders' posterior side.

- Exercise for toning the abdominal muscles.
- Exercise for toning the lumbar segment's muscles and abdominal muscles.
- B. Stretching exercises for lower limbs
- Exercise for toning the thigh
- Exercise for toning thigh and calf muscles and softening the Achilles' tendon.

Results

Examination of the patient with osteoporosis implied a thorough anamnesis, a complete clinical exam by pointing out both the changes in the locomotor system, and the potential extra-articular injuries as well as a complete set of laboratory and imagery explorations. The following were assessed:

1. Pain
2. Lumbar spine mobility
3. Lower limbs perimeter

1. Fighting-off pain

In order to estimate pain, I used the Visual Analogue Scale

Movements of the lumbar spine are tested by:

- Extensions, flexions
- Bending forward;
- Inclinations, rotations

In the initial testing of the 1st clinical case, a level 10 value was registered and the 2nd clinical case is at level 8. After the final testing of both cases, the following level 2 values were reported

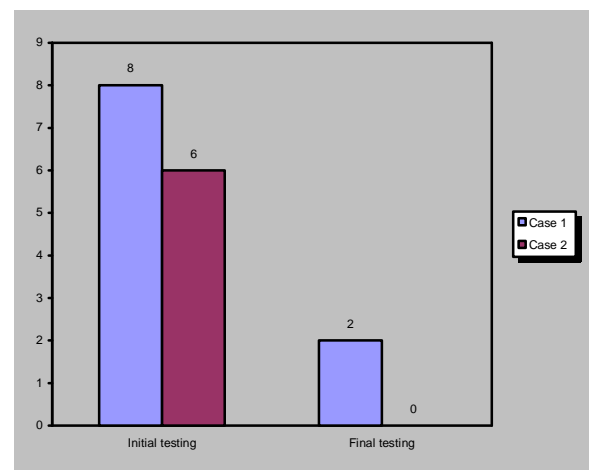


Chart 1. – Comparative analysis of initial and final results on pain assessment

2. Spine mobility

For this test I have used the **Schober's Test** which measures the lumbar spine's flexion. The following results were registered: In the initial test of

the 1st clinical case a value of 2 cm and in the 2nd clinical case a value of 3 cm was registered.

Clinical case	1	2
Initial testing	2 cm	3cm
Final testing	7 cm	5 cm

The following results were registered in the final testing: final testing of the 1st clinical case: value is 7 cm, and in the 2nd clinical case a value of 5 cm was registered. We thus notice a 2 cm increase between the initial and final testing.

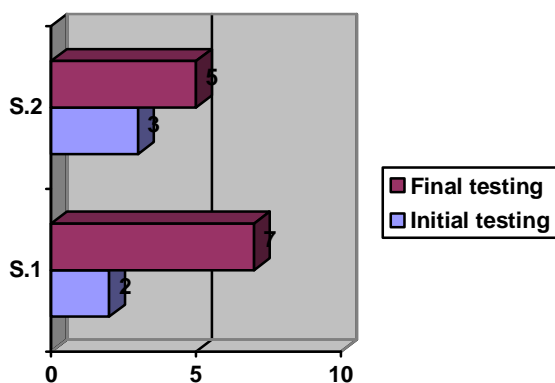


Chart 2. – Comparative analysis of results in mobility assessment Schober's test

Another test for lumbar spine's mobility was carried out using the fingertip-to-floor test, where the distance between the ground and the tip of the long finger is measured, after performing the spine flexion.

The following results were obtained: In the initial test, the 1st clinical case registered 4 cm mobility, and the 2nd clinical case registered a mobility of 5 cm. After the final testing, the distance toward the ground diminished to 1 cm in the 1st clinical case, and it was 2 cm in the 2nd clinical case

Subject	Case 1	Case 2
Initial testing	10 cm	13 cm
Final testing	5 cm	7 cm

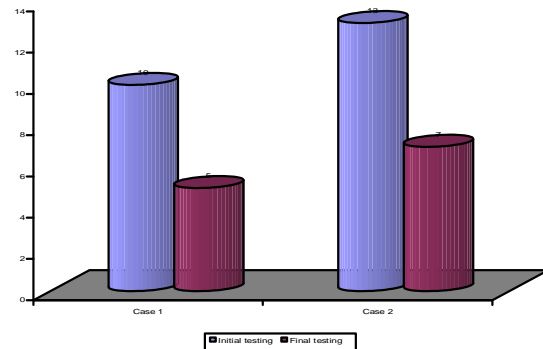


Chart 3. – Comparative analysis of results in the assessment of lumbar spine's mobility

3. Thigh perimeter

I assessed the thigh perimeter because I think that improving the muscle mass would cause the increase in vascularization of the bone tissue, and this would lead to the restoration of the bone affected by osteoporosis. Thigh perimeter assessment was made using the metric band and the following results were reported:

In the first clinical case we have the following results:

Thigh perimeter	Initial testing	Final testing
Contraction	37	39
Relaxation	34	36

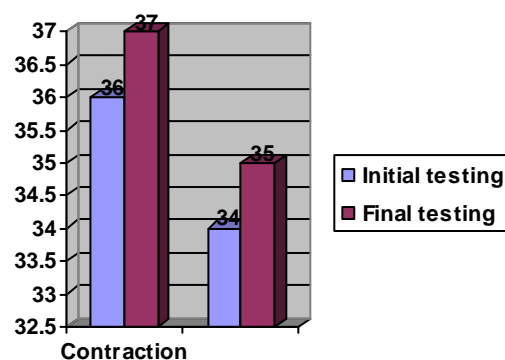


Chart 4. Comparative analysis of initial and final results in the assessment of thigh perimeter for the 1st clinical case

In the 2nd clinical case we have the following results:

Thigh perimeter	Initial testing	Final testing
Contraction	38	41
Relaxation	37	38

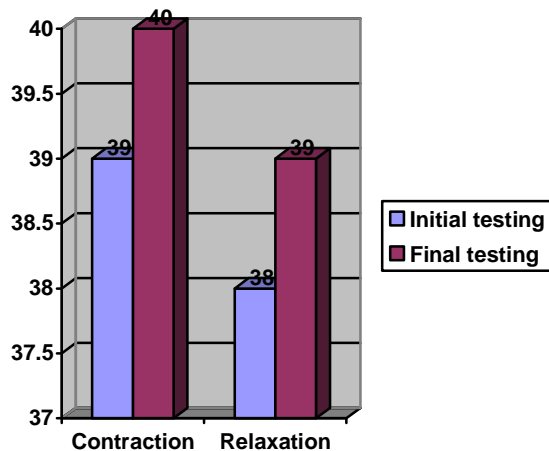


Chart 7. Comparative analysis of initial and final results in the assessment of thigh perimeter for the 2nd clinical case.

Discussions

Popescu and Ciculin 2008, in the scientific paper "Kinetoterapia – mijloc de profilaxie și tratament în osteoporoză" (*Kinesiotherapy-prophylaxis and treatment means in osteoporosis*) make a detailed description of the kinetic objectives and exercises used in the treatment and prophylaxis of osteoporosis in the third age persons.

Budică 2010, in his doctoral thesis "Tratamentul preventiv în osteoporoză-reducerea riscului de fractură" (*Preventive treatment in osteoporosis – reducing the risk of fractures*) has had as main objective to develop a protocol to optimize osteoporosis treatment and diagnosis in patients with fragility fractures.

With a view to reaching the goal and the objectives set, I have conducted an observation retrospective study with a prospective component. By the study's retrospective component, the author has analyzed the clinical – therapeutic characteristics of patients aged 60 years.

Conclusions

Kinesiotherapy is an instrumental means to osteoporosis prophylaxis.

Early intervention is very important, because it prevents more serious lesions from occurring and it stops bone density loss.

Osteoporosis pathogenicity is complex and multi-factorial, alteration of the bone mass density being just the end common way whereby pathological factors affect the risk for future osteoporotic fractures.

In order to understand the pathogenicity of this entity, the mechanisms interpenetrated by maintenance and formation of bone mass in adult have to be known.

Changes in the hormonal status, particularly the estrogenic one, are important factors both in bone formation, and its resumption.

Any disturbance of growth hormones activity, musculoskeletal function, calcium and vitamin D absorption from food intake, as well as genetic factors are also important pathogenicity factors.

The exact definition of the genetic factors' role and their interaction to the environmental and hormonal factors shall mean an important progress with the possibility to improve the diagnosis and treatment practices for osteoporosis.

Avoiding lordosing and kyphosing postures, along with avoidance of bending forward the head are a golden rule in osteoporosis' kinesiotherapy.

The kinetic programme in osteoporosis is intended to tone the paravertebral and abdominal muscles, thus determining the increase osteoporosing spine density and activation of bone periosteum by physical exercises, which constitutes a stimulus for bone formation.

Aknowledgements

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