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Effects of a medical kinetic program on QoL and reactive depression in a group of women with postmenopausal osteoporosis

Efectele unui program de gimnastică medicală asupra calităţii vieţii şi depresiei reactive la un lot de paciente cu osteoporoză post-menopauză

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Abstract

Background. To confirm that medical kinetics is a valuable adjuvant method alongside standard osteoporosis pharmacological therapy, improving the clinical, functional, socio-professional and psychological status of women with osteoporosis.

Aim. To study the effects of a medical gymnastic program for the improvement of the general health status in women diagnosed with postmenopausal osteoporosis, based on monitoring the evolution of some clinical and functional parameters such as pain, musculoskeletal dysfunctions, balance and coordination, psychic status and quality of life.

Methods. We conducted a prospective study on 30 women over 45 years old diagnosed with postmenopausal osteoporosis, divided in two equal study groups: 15 of them were integrated in a specific kinetic program for three weeks with physical exercise in the Rehabilitation Clinic (the study group) and the other 15 patients did not follow the kinetic program (the control group). All the patients were scored for Quality of Life (Qualeffo 41 questionnaire) and depression (Hamilton 17 questionnaire) at the beginning and at the end of the study.

Results. The average Qualeffo 41 score demonstrated a significant decrease in the study group (with an average decrease of 24.5%) for patients who underwent the physical exercise program for 3 weeks, in the comparable initial scores conditions. The outcome of the medical gymnastic program proved to help the depressive state of the patients with osteoporosis after menopause, as the Hamilton 17 score had a significant improvement in the study group (with an average increase of 30.6%).

Conclusions. The results of the study recommend a multi-component and complex exercise program including resistance and balance training, respiratory gymnastics and occupational therapy for women with postmenopausal osteoporosis and reactive depression, but the program is strictly individualized and permanently monitored and re-adapted by the therapist.

Key words: postmenopausal osteoporosis, physical exercise (kinetic program), quality of life, reactive depression, Qualeffo 41 score, Hamilton 17 score.

Rezumat

Premize. Gimnastica medicală reprezintă un factor adjuvant important (alături de terapia standardizată farmacologică a osteoporozei) pentru creşterea statusului clinico-funcţional şi psihologic la pacientele cu osteoporoză post-menopauză.

Obiective. Studiul efectelor unui program de kinetoterapie asupra îmbunătăţirii stării de sănătate a unor paciente diagnosticate cu osteoporoză de postmenopauză, urmărind evoluţia unor parametri clinico-funcţionali: sindromul dureros, sindroamele disfuncţionale de la nivelul aparatului locomotor, echilibrul şi coordonarea, forţa şi rezistenţa musculară şi, nu în ultimul rând, starea psihică şi calitatea vieţii.

Metode. Colectivul de autori a condus un studiu prospectiv cuprinzând 30 de paciente cu vârste peste 45 de ani, diagnosticate cu osteoporoză post-menopauză, împărţite în două grupuri egale – jumătate au urmat un program de gimnastică medicală de trei săptămâni în Clinica de Recuperare (grupul de studiu), iar cealaltă jumătate nu a fost integrată în programul kinetic (gru-

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pul de control). Toți pacienții au fost evaluați pentru calitatea vieții (chestionarul Qualeffo 41) și pentru depresie (chestionarul Hamilton 17), la începutul și la sfârșitul studiului.

Rezultate. Valoarea medie a scorului Qualeffo a scăzut semnificativ (în medie cu 24,5%) la pacientele care au urmat gimnastică medicală. Tot la acest grup s-a constatat și îmbunătățirea atitudinii depresive, scorul Hamilton crescând cu 30,6% la sfârșitul perioadei de tratament.

Concluzii. Rezultatele studiului pledează pentru integrarea pacientelor cu osteoporoză post-menopauză și depresie reactivă într-un program complex de gimnastică medicală bazat pe exerciții de rezistență și echilibru, training respirator și terapie ocupațională, care să fie strict individualizat, monitorizat și adaptat periodic de către terapeut.

Cuvinte-cheie: osteoporoza post-menopauză, gimnastică medicală, calitatea vieții, depresie reactivă, scorul Qualeffo 41, scorul Hamilton 17.

Introduction

Osteoporosis rehabilitation should aim to reduce pain and disability, but also to stop bone loss and prevent fractures. The primary goal of any treatment for osteoporosis should be decreasing fracture risk (Mologhianu, 2007).

Among the multiple possible therapeutic modalities used, the most efficient seems to be physical exercise (Kelley et al., 2013; Vieira, 2013).

The benefits of exercise are independent of the other therapies (Iwamoto, 2013).

Exercise is an essential adjunctive method to diet and drug therapy. It has been demonstrated that exercise has a site-specific effect, but no significant difference between various types of exercise regarding the load for a certain area could be proved (Turner & Robling, 2005).

The risk of fractures can be equally reduced by antiresorptive or bone-forming drug administration and by performing a regular exercise program. The best effect is achieved when the two types of therapy are associated. Also, a part of the rehabilitation program must be devoted to coordination and balance (Davis et al., 2004). Balance disorders and risk factors for falls are present in a significant percentage after 65 years of age and should be treated pharmacologically and with specific exercise programs. Today, there is an extensive documentation with objective data demonstrating the effectiveness of Tai Chi programs to improve balance and coordination in the elderly, for prevention of falls (Chyu et al., 2010).

There have been meta-analyses of different studies regarding the effects of exercise in osteoporosis, assigning them different scores depending on duration, type of study, inclusion criteria and objectives. All trials analyzed bone mineral density changes in postmenopausal women, under the influence of a controlled exercise program, using study groups and control groups (Martyn-St James & Carroll, 2008). Most studies were conducted in women with different BMD, who were more frequently healthy or had mild osteopenia and less frequently osteoporosis. The conclusions of most studies were that exercise induces a minimal increase in BMD (0.6-0.7% per year), which is statistically irrelevant under the conditions of a steady decline of at least 1% per year, thus resulting only in a decrease in bone loss and not an actual increase in BMD. Exercise, although not compensating for bone loss in the first years of postmenopause, may slow its rate in the coming years (Ma et al., 2013).

The European Federation of Sports Medicine Associations' (EFSMA) guidelines for osteoporosis include exercises with the following characteristics (***, 2015):

- Frequency: more than 5 times per week
- Intensity: 40-70% VO2 max, RPE 10-13
- Time (duration): bouts of >10/min or accumulate 30 min/day
- Type of training: aerobic weight-bearing activities, balance training, sensorimotor training
- Type of sports: jogging, walking, aerobics
- Strength training: >2/week, 8-12 reps max, 1-3 sets.

Medical exercise programs - prophylactic and therapeutic - in osteoporosis significantly improve the quality of life of patients, represent true socialization programs, restore the patients' confidence in the improvement of clinical and functional status, benefits related to mood, self-esteem, health, leisure activities and social life. The improvement of quality of life is a very important goal today and can be significantly influenced by PRM specific therapies. Some studies show a considerable improvement in the quality of life of all patients who were integrated in an exercise program regardless of the type of workout (Basat et al., 2013).

Increasing the prevalence of major depressive disorder requires a thorough search of the causes of depression and the development of targeted treatments and complementary therapies that could increase QoL in depressed patients. Exercise has been shown to be effective in treating major depression; several studies have reported its effectiveness to be comparable to that of antidepressant medication (Blumenthal et al., 2007).

Moreover, physical exercise appears to be useful in treating depression in both inpatients and in outpatient treatment regimens (Schuch et al., 2015).

Despite its proven efficiency, the exact mechanisms by which physical exercise exerts its antidepressant effect remain unclear, with assumptions derived from studies on animals or which have study populations of subjects without depression (Dunn et al., 2005).

Imbalances of central monoamine systems, particularly serotonin, noradrenaline and dopamine, have long been the key players in the development and maintenance of depression, and a correction of these imbalances may be a mechanism through which physical exercise improves depressive symptoms. Another possibility would be b-endorphins, natural opioids proven to increase after physical exercise and to relieve depression and pain. However, limitations of methodology in the study of activity in the brain at neurotransmitter levels in humans prevent the attainment of clear-cut evidence (Schuch et al., 2016).

Among the mechanisms which are assumed to explain the antidepressant effect of physical exercise are its influence on several systems such as the neuroendocrine system,

neurogenesis, oxidative stress, the immune system and structural changes of the cortex. This influence is exerted both by responses which occur during or immediately after the exercise program and adaptive changes that occur in the long term, after a long period of training. Depression significantly affects the quality of life of patients. Furthermore, an inverse relationship between quality of life and the severity of depression symptoms has also been reported. Physical exercise is proven to have positive effects on certain areas of quality of life in healthy subjects and in patients with moderate depression (Brosse et al., 2002).

Objectives

To analyze and quantify using specific assessment tools the benefits of physical exercise (a kinetic program) during a Rehabilitation Medicine program on quality of life and reactive depression in patients with postmenopausal osteoporosis.

The final goal of the study was to confirm that medical kinetics is a valuable adjuvant method besides the standard pharmacological therapy for osteoporosis to improve the clinical, functional, socio-professional and psychological status of women with osteoporosis.

The researchers followed some major therapeutic objectives:

- Reduction of pain
- A better global physical and muscular condition
- Improvement of psychological status and reduction of depression
- Better functional independence for basic ADLs and gait
- Better quality of life
- Improvement of participation and integration in domestic and socio-professional activities

Hypothesis

The authors presumed that a medical gymnastics program based on aerobic exercise has benefits for postmenopausal women with osteoporosis and depression, and they designed a study based on the monitoring of differences in some clinical and functional parameters (such as pain, musculoskeletal dysfunctions, balance and coordination, mental status and quality of life) between patients who attended a specific medical gymnastics program and those who did not.

Material and methods

All the patients in the study gave their informed consent prior to their inclusion in the study. The study was performed in accordance with ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. The study was approved by the Hospital Ethics Committee.

The research protocol was structured as a prospective study.

a) Period and place of the research

The research was conducted over a period of 14 months, from May 2014 to July 2015, in women diagnosed with postmenopausal osteoporosis, who presented for medical evaluation and treatment to "The National Institute of Rehabilitation, Physical Medicine and Balneology" in Bucharest.

b) Subjects and groups under study

There were 30 patients diagnosed with postmenopausal osteoporosis after a global medical examination and investigations. All of them received pharmacological therapy based on international drug indications for osteoporosis (the patients received pharmacological therapy with bisphosphonates - sodium alendronate/ risendronic acid/ ibandronic acid + vitamin D3 800-1000 IU/ day + calcium 1000 mg/day). All patients included in the study had to fulfill the inclusion criteria, then they were randomized to two equal groups: 15 women were included in a specific kinetic program consisting of medical gymnastics in the Rehabilitation Clinic (the study group) and the other 15 patients did not follow the kinetic program (the control group).

- *General inclusion criteria*: postmenopausal females, Caucasian patients; age over 45, primary osteoporosis diagnosis based on DXA examination with T-score $\leq$ -2.5; absence or presence of osteoporotic fractures (consolidated); subjective mood/disposition/emotional changes with sadness and lack of interest; cooperation and therapeutic adherence.

- *General exclusion criteria*: secondary osteoporosis; psychiatric or neurological disorders with cognitive and/or negative cooperation impact, decompensated cardiovascular or respiratory diseases with restriction or interdiction of physical effort; chronic severe diseases with potential decompensation during the kinetic program (kidney or liver failure, post-transplant diseases, etc.); severe locomotion problems with impossibility/limitation of medical exercises; non-consolidated fractures, severe depression under specific treatment.

c) Tests applied

All the patients who met the general inclusion criteria were evaluated before and after the study; 15 patients who met the specific kinetic group exclusion criteria did not follow the *medical gymnastics program* and represented "the control group"; the other 15 subjects were "the study kinetic group" and were integrated in a 3-week physical exercise program.

We used a unitary evaluation chart for each patient, based on objective evaluation (by the therapist) and subjective evaluation (by the patient) for a complex assessment regarding:

- *Spine mobility and muscle strength* - using clinical examination.
- *Pain* - VAS score.
- *Quality of life* - QUALEFFO 41 questionnaire (41 questions regarding 7 main domains of quality of life – pain, activities of daily living, self-caring and grooming, general mobility, general health and mental health subjective experience; the total score is the sum of all answers, with points between 0 and 4).
- *Depression* - Hamilton DE questionnaire (17 questions regarding subjective depression experience; the total score is the sum of all answers, with points between 0 and 4).

The questionnaires were applied to each patient of both groups at the beginning and at the end of the rehabilitation program.

Therapeutic methodology

For the study group, we created a therapeutic kinetic program based on general principles of medical exercise, adapted and optimized for each patient, according to individual factors (static and dynamic spinal syndrome, pain intensity, age, history of fractures, associated diseases, exercise capacity). All 15 patients of the study group were integrated in the medical kinetic program for 3 weeks, with daily sessions of 60 minutes, 5 days/week.

All the subjects were informed about the study and gave their written informed consent. The institutional Ethics Committee approved the study protocol. All data were obtained in agreement with the Declaration of Helsinki regarding studies on human subjects.

Objectives of the medical kinetic program

- Beneficial influence on muscle-related pain syndromes
- Correct posture and spine alignment
- Better muscle strength for a proper functional spine tone
- Decreasing the risk of falls and possible fractures
- Better ventilation and exercise capacity
- Secondary prophylaxis by learning and respecting the "back school" principles

The medical kinetic program consisted of:

- Correct postural and spinal alignment: during the natural history of osteoporosis, there are major static changes of the spine (including dorsal kyphosis, dorsal/lumbar scoliosis, hyperlordosis), aggravating muscle imbalance and generating pain and dysfunction. Through specific exercises in each spinal region (cervical/dorsal/lumbosacral) and depending on static spinal changes (rectitude/lordosis/kyphosis), the therapist creates an individual program with exercises based on training correct posture regaining, self-control for maintaining correct alignment during daily activities, in sitting or reclining position. Orthotic devices may be needed for selective cases (5 patients of the study group); dorsal or lumbosacral orthoses may be useful for decreasing the mechanical load and compressive forces on vertebras, decreasing ligament overstretching, compensating poor muscles, during painful acute periods of chronic spinal problems, fracture immobilization.

- Muscle strength exercises: isometric analytical and dynamic, progressive resistive exercises for strengthening the main muscle groups for a correct posture and alignment: paraspinal extensors, abdominals, gluteal muscles – all of these contribute to a proper "natural muscular orthosis" which allows spinal functioning without discomfort/pain. For a perfect muscular balance between extensors and flexors, patients perform stretching exercises for muscles with a tendency to contracture or retraction in shortened position, especially pectorals and psoas-iliac muscles. The kinetic program consists of a short warm-up, progressively intense periods of isometric alternating with dynamic exercises, with short relaxing and breathing intervals, and ends with some general cool-down movements.

- Respiratory gymnastics: because of the static spinal changes induced by osteoporosis (especially kyphosis and scoliosis in the dorsal region), the thoracic cage progressively suffers anatomical and functional changes, with restrictive respiratory problems in time. This is the reason for associating respiratory gymnastics for women with osteoporosis as prophylaxis and/or therapy, consisting of intercostal muscle strengthening, breathing exercises with regional perception (superior/inferior dorsal or abdominal breathing), proper inhaling and exhaling techniques for a better energetic economy during rest and effort. Ergometric cycling for 5 minutes at a submaximal intensity (70-80% of VO_{2max}), along with the general kinetic program, also improves the cardiovascular effort capacity of patients, with longer dyspnea-free periods and walking distances, for a more functional independence.

- Gait training and balance and coordination exercises: programs based on walking on plain and slope land, obstacles dribbling, mobile platform exercises, technique, static and dynamic balance exercises, falling techniques are very useful for old patients in general, but more efficient for osteoporotic women whose risks of fracture are greater than in the rest of the population. This kinetic program will help the patient to have more stability in standing and walking, with less risks of falling and a better capacity to prevent fractures by a better "how to fall" technique.

- Secondary kinetic prophylaxis or "the back school": general rules of "back hygiene" for preventing further spinal problems (discomfort/pain, progressive muscular deconditioning, spinal static deformity worsening, respiratory restrictive problems, etc.), which consist of learning (with the therapist) and practical application of correct posture/alignment at work, at home, during sleep or sitting position, occupational therapy advice (regarding proper shoes and orthosis, chair, mattress, pillow, ergonomics for work/home/car, adaptive assistive devices such as canes or sticks), advice for proper recreational activities and sports (good for spinal muscle training, not with flexion/extension/torsion of the spine, avoiding weight lifting/manipulation, avoiding sports or activities with a high risk of falling, etc).

d) Statistical processing

The statistical analysis of results from individual charts was based on basic statistical principles and was performed using Microsoft Excel and SPSS (the 17th version).

Descriptive statistics

- Arithmetic means, means without extreme values and standard deviations for quantitative variables, expressed as *mean* (± *standard deviation*)
- Frequencies and percentages for qualitative variables.

Significance tests

For evolutions between determinations, for identifying those parameters which improved during the study, but also to identify the differences between groups which could determine the categories with better results.

- Statistical comparison of sample means with the paired t-Student test (2 means), an analysis that can identify the possible significant evolution of numerical parameters.
- Statistical comparison of percentages using the Chi square test, for identifying the possible significant evolution between different groups of patients defined by parameters (yes/no).
- Statistical comparison of numerical variables with Matlab analysis for identifying possible significant differences between the previously defined patients.
- Statistical estimation of the results was performed

for a minimum significance threshold accepted in biology (p=0.05) and for a statistical precision of 95%, using statistical test decision criteria.

Results

Using the anamnestic data, clinical examination parameters and evaluation chart values before and after the study, processed by the previously described statistical analysis, the results were as follows:

The epidemiological results obtained in the studied patients correspond to the general epidemiological data from the international literature. The profile of the Caucasian woman at high risk for postmenopausal osteoporosis progressively increases with age; the mean value in the studied patients was 71.33 years, with extreme age values between 55-83 years; most of the patients (60%) were aged over 70 years. In the control group, the mean age was 70.67, with a minimum of 56 and a maximum of 83 and a standard deviation of 9.671. In the study group, the mean age was 72, with a minimum of 55 and a maximum of 84 and a standard deviation of 7.755. Physiologically, menopause begins at the age of 45-55 years, which is also true for the patients in this study, who had a mean age at menopause of 50.6 years and extreme age limits between 43 and 55 years, with the greatest distribution (65% of cases) in the 50-55 year range. In the control group, the mean age of menopause was 50, with a minimum of 43 and a maximum of 55, and a standard deviation of 3.352. In the study group, the mean age was 50.87, with a minimum of 45 and a maximum of 55, and a standard deviation of 3.067.

Evolution of parameters describing quality of life (QoL)

- The "pain" parameter: at the first evaluation, the mean pain score was comparable in the control group (13.86 points) and in the study group (13.26 points), but at the end of the study, there were significant differences between the control group (14.2 points) and the study group (6.06 points after 3 weeks of sustained medical gymnastics). The decrease by 7.2 points in the mean pain score represents a significant improvement by 54.26% of the mean pain score (statistically significant paired T score; $p<0.001$) for patients who were included in a kinetic program.

- A better quality of life for the study group patients was also reflected by an improvement of the quality of pain-free sleep (83% of the patients who performed exercises reported the absence of night pain at the end of the study, compared with the control group, in which the mean pain during the night score slightly increased from 2.06 points to 2.2 points during the 3 weeks).

- The frequency of back pain expressed as painful days during a week (between 0 points for absence of daily pain and 4 points for daily pain) showed a significant decrease in the study group, where 93.33% of the subjects had fewer painful days than before the kinetic program (the initial score was 3.73 and decreased by more than 50%, to 1.53, at the final evaluation). In the control group, 11 patients of the 15 women (73.33%) had daily back pain and an initial mean score of 3.53, while after 3 weeks, without kinetic therapy, the mean score increased to 3.6 points.

- Another pain parameter with impact on quality of life is the painful period during the day, quantified by the subjects by scores from 0 (no pain) to 4 (all day persisting pain), which at the initial evaluation were approximately the same: 3.26 points in the control group and 2.86 points in the study group. At the final evaluation, the results were different, proving that medical exercises had an important role in pain during the day (based on posture and muscle strength): the mean score decreased to 1.2 points in the study group and increased to 3.33 points in the control group.

Activities of daily living (ADLs) parameters

- QUALEFFO 41 has 4 questions regarding quality of life through the possibility/difficulty to do usual things, such as dressing/undressing, toilet and shower usage, sleep disturbances, self-assessed by patients by scores between 0 points (no difficulty doing that ADL) to 4 (impossible to perform that ADL). The mean ADL score showed an improvement after the kinetic program in the study group (a significant 30% decrease from the initial 7.8 points to the final 5.33 points) and no amelioration of ADLs performance for the control group (6.26 points initially and 6.4 points at the end of the study).

- "Usual domestic activities" parameters: home cleaning, dish washing, food preparation, manipulation of 10 kg objects – the performance of all these activities gives a measure of the subject's functional independence and is part of the concept of "quality of life". High scores indicate poor quality of life. All the subjects in the study had these parameters affected; at the initial evaluation, the mean score was 12.06 points in the control group and 16.13 points in the study group. At the end of the study, only the study group showed an improvement in domestic activities performance, with a decrease by 2.4 points in the mean score, showing a greater functional independence at home for women who were trained by kinetic therapists.

"Mobility" parameters

Seven of the questions of the Qualeffo 41 questionnaire are related to activities that imply motion and gait, with scores between 0 points (no difficulty) and 4 points (severe difficulty/impossibility) for performing simple activities such as: standing up from sitting position, squatting, kneeling, 100 meter walking, one floor stairs climbing, shopping, public transportation usage; all these activities allow a proper independence at home and around home, transport and interaction for a normal domestic and social life, and contribute to quality of life. Higher scores for these activities are related to difficulty in performing these tasks and diminish a person's QoL. In the study group, the mean score for these "mobility" parameters decreased by 3.2 points (from 18.6 points initially to 15.4 points finally), showing a 17.2% improvement in "mobility" parameters of QoL after kinetic and occupational therapy in the Rehabilitation Clinic. In the control group, the initial and final scores were identical.

"Recreational activities" parameters

The scores refer to the level of difficulty in performing usual sports activities and recreational hobbies, gardening, visiting friends, theater/cinema going, all together as an image of social and family life as part of quality of life. For the study group patients, the medical gymnastics program improved the mean "recreational" parameter score by 1.13 points (from the initial 15.26 points to the final 14.13 points) compared to the control group, in which there was

no difference during the study.

A special question refers to aesthetic changes due to osteoporosis (kyphosis, scoliosis, height loss), and subjects must score the degree of embarrassment felt (0 points - no/ few embarrassment feelings to 4 points - very affected). In the study group, the mean score decreased by 40% after 3 weeks of back school exercises, and even if there was no significant improvement in the patients' appearance, they felt less disturbed by the aesthetic appearance of their spine due to better muscle tone and flexibility, with a better physiological postural control.

"General satisfaction with quality of life in general" is illustrated in three of the questionnaire questions and gives a global image of the impact of osteoporosis consequences on the possibility/ difficulty to perform usual domestic, social and family activities over the past 10 years; possible scores were between 0 points - no difference and 4 points - great difference between present time and 10 years ago regarding great difficulty or impossibility in performing the same usual activities at home and in society. Greater scores mean lower satisfaction with quality of life in general and both groups of patients had high initial mean scores (3.66 points in the study group and 3.53 points in the control group), but an improvement in the general satisfaction with QoL score was recorded only in the study group; after three weeks of medical gymnastics and occupational therapy, there was a decrease to 3.46 points.

The influence of osteoporosis and its consequences on the psychological and mental state of the patients is reflected through the answers to the last 9 questions of the Qualeffo 41 questionnaire. The mean score of this section evidenced the second best improvement (after the pain section score) for the study group, with a 36.09% decrease after the kinetic program (from 14.6 points at the beginning of the study to 9.33 points at the end of the study), and even a small increase of the mean score in the control group (from 19.33 points to 20.26 points). These results prove that physical exercise in osteoporotic patients is also beneficial for their psychological and mental state, leading to greater self-confidence and positive thinking about stopping possible future consequences of the disease.

Evolution of parameters describing the *depression and anxiety level*: using individual answers to the Hamilton DE17 questionnaire at the beginning and at the end of the study, we were able to have a global view regarding depressive thoughts and anxiety. Patients in both groups had similar mean scores (paired t Student analysis) at the initial evaluation (1 point for depression and 1.73 points for anxiety in the study group; 1.53 points for depression and 1.13 points for anxiety in the control group), but final scores were significantly improved in the study group after the medical gymnastics program for both studied sections (0.33 points for depression and 1 point for anxiety in the study group; 1.8 points for depression and unchanged 1.13 points for anxiety in the control group).

A review of the statistical data and results of the main studied aspects is presented in Table I.

Discussions

A 24.5% decrease in the Qualeffo 41 score was found in the study group versus a small increase in the control group (Fig. 1). Because the only treatment method applied to patients of the study group was the kinetic program and the difference was statistically significant, it can be said that special exercises in postmenopausal women have important benefits on overall quality of life.

Table I
Main data and results.

Analyzed parameters	Group category	N	Mean	SD	Mean SD	p
Menopause age	control	15	50.33	3.352	0.866	-
	study	15	50.87	3.067	0.792	
Actual age	control	15	70.67	9.671	2.497	-
	study	15	72.00	7.755	2.002	
Final Hamilton 17 score	control	15	17.80	5.759	1.487	<0.005
	study	15	11.60	6.069	1.567	
Initial Hamilton 17 score	control	15	17.07	6.227	1.608	<0.005
	study	15	17.47	9.463	2.443	
Final Q 41 score	control	15	98.13	17.574	4.538	<0.005
	study	15	71.67	26.381	6.812	
Initial Q 41 score	control	15	96.27	18.297	4.724	<0.005
	study	15	94.93	21.080	5.443	

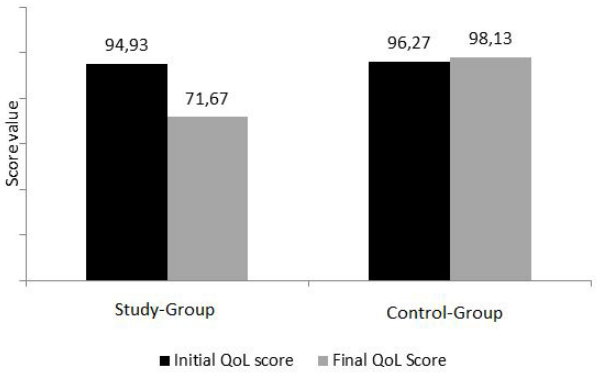

Fig. 1 – Qualeffo 41 score evolution.

Using the "statistics" toolbox of the Matlab software, we established that the data could correspond to a gamma distribution with a mean of 26.57 and a standard deviation of 15.8. Fig. 2 shows the distribution curve of benefits on quality of life for an infinite number of patients as a model (N=infinite).

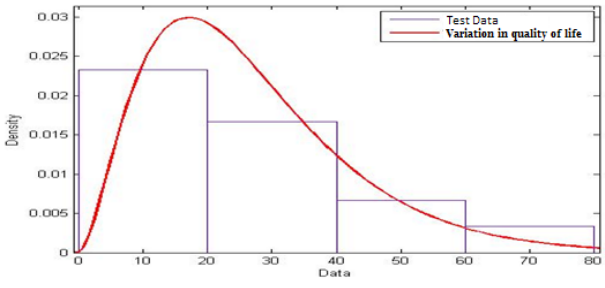

Fig. 2 – Distribution curve of benefits on quality of life for an infinite number of patients.

A 30.6% decrease in the mean depression score was observed in the study group versus a small increase in the control group (Fig. 3). Because the only treatment method applied to patients of the study group was the kinetic program and the difference was statistically significant, it can be said that special exercises in postmenopausal women have important benefits on depression.

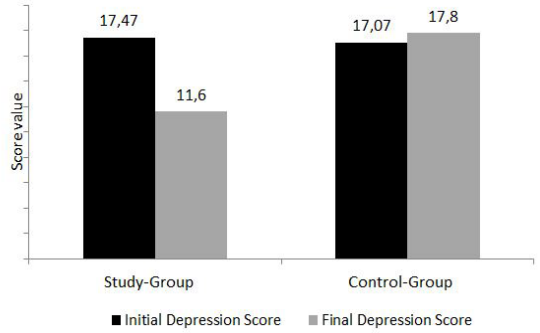

Fig. 3 – Depression score evolution

Using the "statistics" toolbox of the Matlab software, we established that the data could correspond to a logistic-type distribution with a mean of 26.599 and a standard deviation of 21. Fig. 4 is an image of the distribution curve of percentage benefits on the depression score for an infinite number of patients as a model (N=infinite).

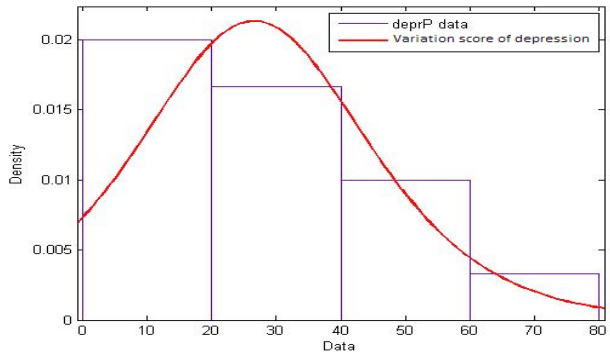

Fig. 4 – Distribution curve of percentage benefits on depression for an infinite number of patients.

Conclusions

1. The individualized kinetic program improved the overall quality of life of postmenopausal osteoporotic women. There was a statistically significant decrease in the mean Qualeffo 41 score in patients of the study group who were trained for 3 weeks, compared to initial scores.

2. The kinetic and occupational therapeutic program proved to have the greatest benefits on "pain", "ADLs" and "mental state", which are the most important categories of activities for defining the perception of "general health and functional independence".

3. Also, physical exercise proved to ameliorate depression and anxiety in postmenopausal patients with osteoporosis, as the Hamilton 17 score showed a statistically significant improvement in the study group.

4. The hypothesis regarding the benefits of an individualized program for postmenopausal women was proved using evidence-based medicine tools, and we recommend it as an important therapeutic method, together with lifestyle adjustments and drug therapy standard protocols. We look forward to future studies on greater numbers of patients, over longer time periods.

Conflicts of interests

Nothing to declare.

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