

Physical Methods in the Prevention and Treatment of Osteoporosis in the Elderly



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Submission: November 11, 2019; **Published:** November 25, 2019

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Abstract

Introduction: Physiotherapy is one of the oldest among medical specialties. Its methods are used for remedial and prophylactic aim. Osteoporosis is one of the most common diseases of present civilization. Analysis of frequency of osteoporotic fracture occurrence in different countries indicates negative influence of civilization's development on it. In Poland 25% of women and 15% of men after 50 years of age have osteoporosis. Osteoporosis treatment is long-term and multidirectional. The most important are prophylactic.

Methods: Healthy education, motor activity and physical methods. Aim of the study Estimation of usefulness and efficiency low-frequency alternate magnetic field /LFAMF/ in the prophylaxis of bone mass loss in patient with chronic spinal pain.

Material and methods: subjects' group 60 men with chronic spinal pain / mean age 68.6 years/ treated with series procedures with LFAMF. Bone density / densimeter/ and pain intensification / Laitinen's scale/were estimated.

Study schedule: exposure time 12 minutes to thoracic spine and 10 minutes to lumbosacral spine. 40 procedures- once a day/20days/ and next twice a week for 3 months. Procedures were repeated after 3 months.

Results: After 1year increase / 1.81%/ of bone density was observed in study group which received series procedure with LFAMF.

Conclusions: Good therapeutic effects in all patients treated with LFAMF indicate purposefulness of this method in osteoporosis prophylaxis. This method should be applied in practice in wider range because of its effectiveness, easiness and no side-effects.

Keywords: Physiotherapy; Health; Prophylaxis

Introduction

Osteoporosis is one of the main diseases of our modern civilization. More than 25% of women and 10% of men over the age of 60 are diagnosed with osteoporosis. An analysis of the prevalence of osteoporotic fractures in various countries indicates that the development of civilization has a negative effect on the problem [1-6].

Our lives are dominated by

- Low physical activity
- Inappropriate diet
- Too much animal fats
- Too much carbohydrates and salt
- Too little calcium
- Too little fresh fruit.

We have too much

- alcohol, tobacco, coffee

- stress
- Too little exposure to sunlight.

In Poland, osteoporosis is found in 25% of women and 15% of men over the age of 50. In the fifth decade of life the spine starts undergoing involuntional changes. At first, cortical bone loss does not exceed 0.3-0.5% per year. Annual lamellar bone loss reaches 0.6-2.4% in women and 1-2% in men. Aging processes are always accompanied by the limitation of mobility and physical activity to a necessary minimum while the bones lose their natural stimulator of osteoporosis. Women develop age-related osteoporosis 2 times more often than men [7-10]. The use of new methods of measuring bone density (SPA, DEXA, QCT) and biochemical markers of bone turnover allows for early diagnosis and determining the degree of metabolic disturbances of the bone tissue and its density. The treatment of osteoporosis, which is a chronic and progressive disorder, is long and multidimensional. Apart from pharmacological treatment, it is vital to introduce preventive measures

health education and elimination of risk factors

- i. Appropriate diet
- ii. Appropriate physical activity
- iii. Use of physical methods
- iv. Health resort treatment

Health education is extremely important, especially in patients with risk factors for osteoporosis. It is often necessary to change one's lifestyle as well as dietary habits and introduce appropriate physical activity. Moreover, in the case of advanced osteoporosis the patient's environment has to be altered in order to reduce the risk of fractures [6-12]. The measures aimed at preventing osteoporosis should be introduced at an early age, that is in the period of the bone mass increase, so as to achieve a high peak value of bone mass at the age of 30-35 years. The higher the bone mass at the age of 30, the lower the risk of fractures due to physiological ageing in old age [11-14].

The education is best conducted during a stay at a health resort. Everyday contact with the doctor and the staff helps educate the patients who can also attend talks given by doctors, rehabilitation specialists, and dietitians. In addition, this place allows the patients to exchange experience. Appropriate diet is a basic element of osteoporosis prevention. It is crucial to convince the patient that it is necessary to follow the instructions concerning the diet, which should be rich in calcium and vitamins while containing limited amounts of protein, salt, and alcohol. Apart from the diet, physical exercise is the other basic part of osteoporosis prevention and treatment. During skeletal growth, proper loading of the skeleton influences the development of a large bone mass and strong high-quality bone while proper spinal loading may slow down the osteoporotic processes during the involutional period [13,14]. We recommend exercise improving the range of motion in the joints, coordination, and general physical function and gradually introduce resistance exercises. The most important part of the treatment is proper selection of exercises and loads, depending on the severity of osteoporosis, and adapting them to the patient's general physical performance [14-18].

The treatment and prevention of osteoporosis involve light therapy and phototherapy using UV light which stimulates the production of vitamin D₃ in the skin. We recommend ultraviolet-B wavelengths ranging from 280 to 315 nm. Sunlight is the best stimulator of vitamin D synthesis, but in our climate zone there is too little sunlight during the 5-7 colder months of the year. Consequently, in the autumn and winter it is advised to use even a simple quartz lamp as a preventive measure. Irradiation at a dose of 1 MED, which is then gradually increased by 1 MED every two days, is applied from a distance of 1m. A physical therapy method directly stimulating the improvement of bone density is the use of Variable Low Frequency Magnetic Fields (VLVMF). Studies have confirmed that it accelerates bone union and facilitates the treatment of nonunion. Some publications

report improved bone mineralization in osteoporotic patients. In osteoporosis it is recommended to use triangular VLVMF (15 mT, 10 Hz) at the site of bone defects for 12 minutes 3 times a day during more than ten weeks.

Low and medium-frequency electrical currents may play a supportive role in reducing the pain and inflammation caused by osteoporosis. This allows the patient to follow the rehabilitation programme and take physical exercise. Ionophoresis with calcium chloride is routinely recommended in local osteoporosis. The procedure involves the use of 1-2% calcium chloride (CaCl₂) from the positive electrode. Systemic cryotherapy is also recommended in osteoporotic patients. It has an analgesic and anti-inflammatory effect and relaxes the muscles. Together with a kinesiotherapy programme, it indirectly improves the range of mobility and increases muscle mass [19,20]. Recommended balneological procedures include therapeutic mud compresses on the spine and peripheral joints. Therapeutic mud components have a positive effect on the musculoskeletal system. Kinesiotherapy procedures in brine pools allow for taking exercises with no loading, thanks to which the patients are sooner able to ambulate freely after musculoskeletal injuries or surgeries and can perform resistance exercises which strengthen the skeletal system and accelerate the metabolism of bone formation.

Therapy with natural potable mineral calcium, fluoride, and magnesium waters may be helpful in the treatment of osteoporosis as it is an additional source of calcium. These waters include fluoride waters in Cieplice and Łądek Zdrój as well as hydrogen carbonate and magnesium waters in Krynica, Polanica, Szczawno, and Duszniki. Brine from Ciechocinek contains calcium and magnesium ions [19,20]. The aim of the study was to assess therapeutic usefulness and efficacy of Variable Low Frequency Magnetic Field (VLVMF) in bone loss prevention in patient with chronic spinal pain. Biophysical mechanisms and biological effects of VLVMF influence on uncompensated magnetic spins of paramagnetic elements and free radicals as well as diamagnetic molecules, influence on liquid crystals, especially cell membrane elements with liquid crystal properties

- a) Displacement of moving electrical charges
- b) Inducing potentials in spaces filled with electrolyte
- c) Influence on depolarization of cells with their own automatism
- d) Influence on structures with piezoelectric and magnetostrictive properties
- e) Intensifying the process of oxygen utilization and tissue respiration
- f) Vasodilatory and angiogenic properties
- g) Increase in soft tissue regeneration processes

- h) Accelerated bone union
- i) Anti-inflammatory and anti-oedema effect
- j) Analgesic effect
- k) Benefits of magnetic therapy
- l) low level of stimuli - may be used in acute cases
- m) Magnetic field penetrates all body parts evenly
- n) Procedures may be conducted through clothes, cast, bandages
- o) Metal implants and foreign bodies are not contraindications to VLFMF treatment (apart from electronic implants supporting organ function, such as cardiac pacemaker)
- p) Effectively influences the connective (bone) tissue
- q) No side effects with long-term application.

4. Material and Methods

The study group consisted of 60 men (mean age was 68.6) with chronic pain in the spine and peripheral joints. It was a group of patients in whom after 3 weeks of physical treatment / diadynamic currents, laser therapy, massage / no improvement in health was achieved. An additional densitometry test was

performed, which showed severe osteopenic changes in patients. Subjective status was assessed on the Laitinen scale. A variable magnetic field of frequency was introduced in the treatment. Parameters of the magnetic field used and the methods of conducting the procedure

- a. Sinusoidal magnetic field (bipolar)
- b. Frequency 50 Hz
- c. Field strength 2.5 mT
- d. Exposure time: 12 min. on the thoracic section
- e. + 10 min. on the L-S section
- f. Series of 20 procedures daily and 20 procedures 2 times a week (3 months)
- g. Procedures were repeated after 3 months (2 series per year).
- h. Statistical analyses

Elements of descriptive statistics were used to analyze the collected material, such as: arithmetic mean and median, minimum and maximum value. The statistical significance of the results was assessed using the Student's t test. The level of significance was $p < 0.05$.

Results

Table 1: Results of Densitometry and Laitinen Index After a Year of Observation of Patients.

	L2-L4 Densitometry				Symptom Severity According to Laitinen Questionnaire	
	BMD g/cm ²		T-Score		Before Treatment	After Treatment
	Before Treatment	After Treatment	Before Treatment	After Treatment		
Mean (SD)	1.064±0.062	1.198±0.064	-1.34±0.28	-0.71±0.28	5.9±2.8	3.0±0.5
p-value	<0.001	<0.001	<0.001			

The treatments had a very positive effect on the patient's subjective and objective status. Relief or remarkable reduction of pain and functional improvement were obtained. In densitometric control tests performed after a year of observation, inhibition of osteopenia progression with a clear tendency to increase bone mineral density was obtained. Very favorable changes were observed in the patient's condition in the Laitinen scale. In (Table 1) shows the results obtained.

Discussion

Osteoporosis is characterized by progressive bone loss, weakening of the bone spatial structure and increased susceptibility to fractures. Elderly people have lower bone mass, impaired bone tissue microarchitecture, which leads to increased fragility and susceptibility to fracture. Progression of physical activity that progresses with age leads to osteoporotic changes. At the initial stage, the disease is asymptomatic, backache and long bones appear under the influence of loads. The purpose of prevention and treatment is to prevent bone

fractures which is achieved by increasing bone mass, preventing its loss and improving the internal structure of the bone. People at risk of developing osteoporosis should be preventive, minimize factors leading to osteoporosis, supplement nutritional deficiencies of calcium, vitamin D and proteins. It is imperative to increase physical activity, instruct the patient to exercise to strengthen the muscles and bones responsible for posture stabilization. Elderly patients who come to the Rehabilitation Laboratory with back pain and peripheral joints should have a densitometry test that will determine bone mineral density and facilitate proper diagnosis. In the management of such patients with osteopenic changes, we introduce physical pain management, electrotherapy, and phototherapy, which has a stimulating effect on the production of vitamin D3 in the skin. We commission the ultraviolet B band with a wavelength of 280-315nm. A low frequency alternating magnetic field is a physical method that has a direct stimulating effect on bone growth. Two 3-month series of alternating magnetic fields/After a year of follow-up, a densitometric control test was performed and the

results confirmed the beneficial effects of therapy, inhibition of osteopenia progression and increase in bone mineral density was obtained in patients. Very favorable changes were observed in the patient's condition manifested by resolution or radical reduction of pain. Patients should have a targeted

Kinesitherapy Program

Active relief exercises, caution resistance exercises, closed chain exercises, postural muscle exercises, learning correct posture. Physical-improvement methods should be more widely used in the daily work of geriatricians and family medicine in the prevention and treatment of osteoporosis.

Conclusion

Beneficial therapeutic effects achieved in all the patients treated with VLFMF confirm the efficacy of the method in the prevention of osteoporosis. The analgesic effect of VLFMF, its ability to inhibit the process of bone tissue destruction, easily conducted procedures, and no side effects suggest that this method should be widely used in osteoporosis prevention.

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DOI: 10.19080/OAJGGM.2019.05.555660

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