

APPLICATION OF PHYSICAL THERAPY AND NUTRITION IN THE MANAGEMENT OF OSTEOPOROSIS

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Abstract

Osteoporosis is today one of the most important diseases. It is connected with loss of bone density and hip fractures. The main risk factor that together with hormonal changes accelerates onset of osteoporosis is substantially changed life style, characterized mainly with reduction of physical activity and inappropriate nutrition. Our work is focused on the therapeutic options for this disease with regard to the use of kinesiotherapy as well as to appropriate nutritional composition.

Keywords: osteoporosis, physical therapy, calcium, nutrition, regimen

1 Introduction

Osteoporosis is a systemic skeletal disorder in which bone strength is compromised by the loss of bone density and bone quality. It is one of the most prevalent skeletal disorders; with estimates that up to 30% of women and 12% of men over the age of 50 are affected [1]. The emergence and development of the disease is slow and inconspicuous and often do not cause any trouble to patients. Diagnosis of osteoporosis is established by measurement of bone mineral density or by the presence of a fragility fracture, especially a spine or hip fracture [2, 3]. Bone mineral density in adulthood depends predominantly on growth and mineralisation of the skeleton and the resultant peak bone mass achieved and then, to a lesser extent, on the subsequent loss [4]. Osteoporosis is more prevalent in postmenopausal women since bone loss is part of post-menopausal syndrome [2]. Although standard treatment for post-menopausal osteoporosis is hormone replacement therapy, reported side effects of hormone dependability, such as development of hormone-dependent breast and uterine cancers have prompted the use of alternative therapies [5]. Osteoporosis in men contributes to significant morbidity and mortality. Hip fractures in men are associated with greater mortality (up to 37.5% in the first year) compared with women. Timely diagnosis and treatment of osteoporosis in men are therefore critical [6].

2 Risk factors for osteoporosis

Many risk factors have influence on the incidence and progression of osteoporosis. Some of them we can modify but some not (Fig.1).

The most common modifiable risk factors for bone loss are an inappropriate diet and insufficient physical activity. For bone mineralization calcium absorption is the key factor, which depends on calcium and vitamin D intakes and phosphorus levels, which affect calcium retention [4]. People with increased risk for osteoporosis are also smokers, people consuming large amounts of alcohol and coffee, and variety of drinks with high phosphorus content (such as cola drinks) and people who have a deficiency of vitamin D in the diet [7, 8].

The partially modifiable risk factors are gastrointestinal diseases (e. g. stomach hypoacidity, diseases with decreased absorption of intestine) and certain endocrinopathies (e.

g. diabetes mellitus, hyperthyreosis, hyperparathyreosis or Cushing syndrome). Their influence on the progression of osteoporosis can be partially influenced by the dietary and lifestyle changes or by treatment measures [7-9].

The nonmodifiable risk factors include age, sex, genetic predisposition, and geographic location. Women of childbearing age are protected against bone loss by high estrogen levels. After menopause, this loss will accelerate and can be seen over the age 45. In men, loss of bone mass begins approximately between 55 to 60 years of life. Osteoporosis is most common in the northern regions of America and Europe, while in the south regions its incidence decreases. The reason is the higher intensity of sunlight that causes increased production of vitamin D in people living in these regions. Furthermore, there has been observed higher incidence of osteoporosis by women of white and yellow races compared to the black women due to the faster onset of menopause [7-9].

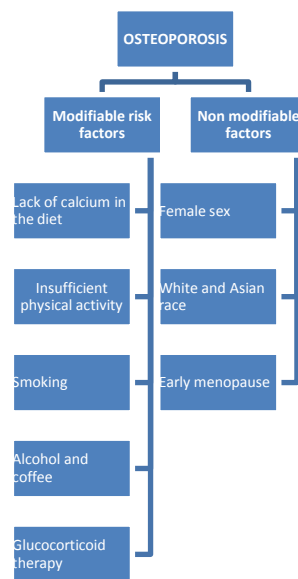


Fig 1: Risk factors for osteoporosis

3 Therapy

Therapy of osteoporosis is a complex process based predominantly on elimination of modifiable and partially modifiable risk factors. It also includes pharmacological treatment of primary diseases causing e. g. lower calcium absorption or hormonal misbalances. The next aim of therapy is the reduction of complications which are associated with osteoporosis (e.g. back pain, fractures) [6, 10-12].

4 Kinesiotherapy

Bone strength is influenced by physical activity. Decreased muscle tension leads to thinning of bone structure. Conversely increased muscle tension increases bone density. These findings are consistent with clinical observations in immobile patients in whom the decrease of muscle activity creates muscle atrophy and thinning of bone structure. After remobilization there occurs a gradual return to the original proportions. Repetitive strain on the musculoskeletal system of sufficient intensity can prevent formation of remodeling disorders like osteoporosis, which are connected with associated increased risk of fractures due to reduced mechanical strength. Therefore, adequate physical activity could slow bone loss while

promoting new formation of bone mass On the contrary, the absence of movement accelerates the degradation of bone [8].

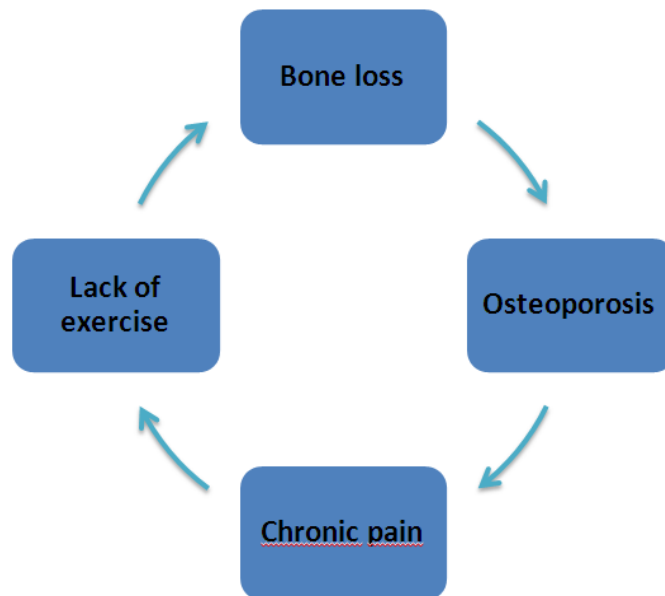


Fig 2: Cyclical relationship between osteoporosis and lack of exercise modified by [8], p.251

Kinesiotherapy is therefore an integral part of the treatment and prevention of osteoporosis. It aims burden bone by movement, release muscle tension, improve muscle strength and overall mobility, coordination, modify incorrect patterns moving and relieve pain. By strengthening the muscles of the torso prevent the generation of vertebral fractures [7, 8, 13].

It is recommended regular walking in duration 30 to 60 minutes. This is a wide stress exercise during which promotes new bone formation. The trend nowadays is the "Nordic walking", walking with special poles, in which, during the walk at the same time relieving the spine. Elderly patients are suitable exercises against resistance without maximum effort. Further there are recommended balance trainer exercises to improve posture, resulting to pain relief on the movement system. Part of kinesiotherapy is also the implementation of elements of the "back school" to daily activities [8, 13].

Patients with osteoporosis should avoid sudden movements, speed walking and running, physically strenuous work (with load). The treatment uses the breathing exercises that lead to relaxation of the respiratory muscles, improve mobility of the diaphragm and ribs and spine release. That leads to correction of overall posture and secondary relieves the pain which is accompanying the osteoporosis. There are also used methods of postisometric relaxation of muscles in increased tensions and for autotherapy are patients taught antigravity relaxation. Patients with osteoporosis most often have heightened tensions in the m.trapezius, m.psoas major and hip adductors. Currently in Slovakia there is used for treatment of osteoporosis certified exercise method. It is a special exercise by Ďurišová, which consists of exercises in standing, supine, lying on the belly and kneeling on his knees. Individual exercises are linked together. It begins with training the correct standing position and then passes into other positions mentioned. Each position is started with stretch exercises and then strengthens muscles exercise [8].

5 Nutrition

Bone is a dynamic and metabolically active tissue; it is constantly renewed at an average rate of 8–10% per year, and the body's need for calcium relative to skeletal growth and

remodeling varies by life stage. The major physiological activities include bone accretion during skeletal growth and maintenance of bone mass after growth is completed. Calcium balance studies have shown that calcium retention is significantly higher in adolescents than in adults with the same calcium intake. Later in adult life, net calcium is lost from the body when bone formation no longer balances with bone resorption [14]. For bone mineralization calcium absorption is the key factor, which depends on calcium and vitamin D intakes and phosphorus levels, which affect calcium retention [4]. Dietary calcium is classically associated with dairy products, and food supplies such as milk, yoghurt, and cheese. In the risk group for the development of osteoporosis are therefore especially vegans, macrobiotics and some people overreact comply with non-fat diet. A special situation is at the lactose intolerant people [8, 9].

The basic condition for successful treatment is a good diet with adequate intake of calcium. Up to 99% of calcium in the body is to be found in the bones and teeth. Moreover, its presence is necessary in the development of muscle contraction. The recommended doses of calcium are in various age groups different. Ďurišová [8] provides minimum dose for an adult person aged 19-50 years 1000 mg. For people over 51 years 1200 mg and over 56 years it is 1500 mg. Daily calcium intake in pregnant and lactating women should be 1500-2000 mg. People with osteoporosis should have a minimum calcium intake 1500 mg per day. For comparison, the Grobers [7] optimal daily calcium intake for both men and women older than 19 years is 1000 - 1200 mg per day and for pregnant and lactating women 1000-1300 mg per day. In patients with osteoporosis Grober recommends daily intake of 1000-2000 mg per day (Table 1) [7, 8].

Table 1: The recommended daily doses of calcium modified by [8], p.213

Category		Optimal daily doses of calcium (mg/d)
Children	0-6 months	400
	6-12 months	600
	1-5 years	800
	6-10 years	800-1200
Adolescents	11-24 years	1200-1500
Men	25-65 years	1000
	Over 65 years	1500
Women	25 years – menopause (HRT* after menopause)	1000
	after menopause without HST and older than 65 years	1500
	Pregnant and lactating women	1200-2000

*HRT – Hormonal Replacement Therapy

The best source of calcium is a natural food, especially milk and milk products. Many people avoid milk and dairy products for the cholesterol content and also because drinking of milk is not recommended by many authors for allergies and possible admixture of toxic substances. In terms of cholesterol, milk with less than 2% fat does not leads to cholesterol increase even recent research show a preventive effect of milk at cancer and cardiovascular diseases. Milk allergy is rare and often confused with intolerance to milk at lactase deficiency. As a non-milk sources of calcium, we can mention e. g. whole meal bread, nuts, poppy seeds, meat, dried figs, apricots, plums, broccoli, kale, chives, parsley and beverages such mineral

water (> 300 mg of calcium / L) and herbal teas. Calcium is better absorbed in an acidic medium. Therefore, in persons with impaired production of gastric juice is resorption of calcium on an empty stomach very low. Here it is recommended to drink acidic juices, eating sauerkraut and pickled cucumbers. Because our body needs calcium for 24 hours a day, it is recommended to consume foods rich in calcium, e. g. yogurt, also before bedtime to secure a calcium intake during the night. It has been proven that the administration of calcium before the bedtime reduces the night peak of parathyroid hormone in the blood, thereby reducing the increased nocturnal bone degradation. Some substances, however, undermine the ability of effective use of calcium in the body. They include foods high in oxalates (e. g. spinach, rhubarb, almonds) and phytates (e. g. legumes, wheat bran), which impair calcium absorption in the intestine. The second group is food rich in protein and sodium, which promote increased urine calcium excretion. Similarly, also acts phosphates and caffeine (colored caffeinated beverages) [7,8].

Uusi-Rasi K. et al. [14] reviewed 38 studies addressing the effects of calcium on the organism. According to the literature, high calcium intake seems to have a small positive effect on bone mineral content or bone mineral density in children and postmenopausal women. They did not find any consistent evidence on the effects of calcium on bone health in premenopausal women or men. Also, the evidence that calcium supplementation reduces fracture incidence was scarce and inconsistent. Maternal diet may influence the peak bone mass of offspring but more studies are required. In most trials reviewed in another study [15], the effects of vitamin D and calcium could not be separated. Vitamin D(3) (>700 IU/day) with calcium supplementation compared to placebo has a small beneficial effect on BMD, and reduces the risk of fractures and falls although benefit may be confined to specific subgroups. Vitamin D intake above current dietary reference intakes was not reported to be associated with an increased risk of adverse events. However, most trials of higher doses of vitamin D were not adequately designed to assess long-term harms.

6 Conclusion

The incidence of osteoporosis in the population of the Slovakia has similar features as in the neighboring countries of Central and Western Europe. In our country the special exercise of Ďurišová is currently used as a certified exercise method.

In the case of nutrition there is necessary to ensure adequate daily intake of calcium, which is, together with vitamin K important factor in bone mineralization. Post-menopausal women without hormonal replacement therapy and older than 65 years, should have a minimum calcium intake 1500 mg per day. It is important to note, that the intake and effects of vitamin D and calcium could not be separated.

In view of the trends in current consumer society, we can conclude that for the most people there will be probably more acceptable treatment with the passive use of pharmaceuticals than active movement and changes of stereotypes in nutrition. Both active solutions of the problem of osteoporosis are more demanding for energy and tenacity.

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