PREVENTING OSTEOPOROSIS IN MENOPAUSE

In both developed and developing countries osteoporosis is a growing health problem that is well recognized. This contributes greatly to the high costs of health care and mortality. Osteoporosis is a disease that is associated with fractures. This is a cause for worry solely because the results are lowered quality of life, people are no longer mobile, occurrences of disability and deaths.

This bachelor thesis focuses on providing patient education on prevention of osteoporosis in menopause and also to produce information in terveys netti.

The method used in this bachelor thesis is literature review. This thesis explains what osteoporosis is, causes, symptoms and complications. It further gives the step by step health education to the public on prevention, diagnoses and interventions.

However, osteoporosis should no longer be considered an old womans disease but rather young women should also be included. Regular physical activity, healthy eating and not smoking can prevent and alleviate problems associated with age-related loss of muscle strength and bone density.

KEYWORDS:

Postmenopausal, Menopause , Osteoporosis, Osteoporosis prevention, Nutrition, Bone mass density and Bone mineral density.
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# LIST OF ABBREVIATIONS

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<tr>
<td>WHO</td>
<td>World health organization</td>
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<td>BMD</td>
<td>Bone mass density</td>
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<td>FDA</td>
<td>Food and Drug Administration</td>
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<td>SD</td>
<td>Standard Deviation</td>
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<td>BMC</td>
<td>Bone mineral content</td>
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<td>PTH</td>
<td>parathyroid hormone</td>
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<td>NOS</td>
<td>National Osteoporosis Society</td>
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<td>SIGN</td>
<td>Scottish Intercollegiate Guidelines Network</td>
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<td>BMI</td>
<td>Body mass index</td>
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<td>IOF</td>
<td>International Osteoporosis Foundation</td>
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1 INTRODUCTION

In both developed and developing countries osteoporosis is a growing health problem that is well recognized. This contributes greatly to the high costs of health care and mortality. This is therefore reason enough to conduct epidemiologic surveys inorder to know the prevalence of osteoporosis and related risk factors within communities. By doing this, long lasting solutions for prevention and control are achieved. (Solomon et al 2005,194.)

One way to recognize that an individual has osteoporosis is the occurrence of fractures because this two are related. This is a cause for worry solely because the results are lowered quality of life, people are no longer mobile, occurrences of disability and deaths. According to world health organization, osteoporosis is associated with fractures hence making it a risk factor and this fractures accr at various sites namely: wrist, spine and hip. The risk factors for fractures are classified as preventable and unpreventable. Most abvious unpreventable factor is being female. (Hertzman and Johnell 2006,7.)

According to Ahlborg et al. 2010, an increase in the number of fractures globally has come about due to increasing proportion of elderly women in the society. In Finland, incidence of hip fractures in women aged 50 years or above increased by 60% between 1970 and 1997 , and in comparison to other regions reports and figures, the pattern is stabilizing. (Kannus et al 1999,802.)

According to osteoporosis foundation fact sheet, 1 in 3 women who are over 50 years will suffer a fracture due to osteoporosis and this increases to 1 in 2 who are over 60 years of age. Approximately 1.6 million hip fractures occur each year worldwide, the incidence is set to increase to 6.3 million by 2050. The highest risk of hip fractures are seen in Norway, Sweden, Iceland, Denmark and the USA. ( IOF 2002.)
Currently, there is an increasing incidence of hip fractures in the developed cities in Asia. This is due to socio-economic development in many Asian countries and rapid ageing of the Asian population. 1 out of 4 hip fractures occur in Asia and Latin America. This number of hip fractures will increase to 1 in 2 by 2050. (IOF 2002.)

Of the 1.5 million fractures that occur in the United States each year, 20% occur at the hip, 50% in the spine, and 30% at the wrist and other sites. The annual worldwide incidence of fracture was estimated to be 1.29 million in 1990, and is projected to grow to 2.6 million by 2025 and to 4.5 million by 2050. (WHO, 2003)

The highest fracture rates are reported from northern Europe, the northern part of the United States, and among South east Asian populations, with the lowest rate from African countries. The risk of hip fracture among Norwegians is four times that of southern Europeans and double that of Americans. It is of note that the differences in incidence of hip fractures between countries are greater than the differences between genders. (Chang et al 2003,4.)

Ageing men are also prone to being diagnosed with osteoporosis but to a lesser degree than women. Women suffer more because they live longer than men due to bone loss that occurs during and after menopause. This is why there are three to four times reported cases of hip fractures in women than men. (Melton et al. 1993,118.)

Another notable reason why osteoporosis is more common in women is due to the fact that bone loss in men starts later and the progression is slow. Men also have an advantage of not having a period of rapid hormonal change and accompanying rapid bone loss. In women the peak bone mass is lower due to the hormonal changes that occur at menopause and the effect of pregnancy. Women need to be cautious about their diet and ensure that it is well balanced because failure to observe this, and given the hormonal changes, calcium composition in their bodies can be altered. Taking calcium supplementation is also advised. (Melton et al. 1993,119.)
While these diseases and consequent fractures, spontaneous or caused by falls, place an enormous burden on the health care system and society, often they do not get the attention they deserve because they are incorrectly seen as an inevitable part of ageing or less serious than such conditions as heart disease or cancer. (Melton et al. 1993,119.)

Unpreventable risk factors are: Age, inherited genes, ethnicity, being tall female gender and menopause happening earlier than usual. Preventable risk factors are: Smoking, excessive alcohol consumption, impaired vision, lack of exercise or not doing enough, low weight, use of corticosteroids, secondary osteoporosis, falling often, inadequate sunlight and low bone density. This bachelor thesis will focus on prevention of osteoporosis in menopause. Menopause occurs over a period of several years and more so continuously meaning ones it starts, it goes on and on. It marks the end of a woman’s monthly period but symptoms begin earlier with exception of some women whose symptoms shows months or years after menopause has occurred. The peak amount of bone attained before menopause and the rate of the bone loss thereafter determine how an ageing woman’s skeleton will be. (Hertzman and Johnell 2006,7.)

According to Ahlborg et al., by the year 2050, the occurrence of hip fractures will rise globally in the female gender by 240% and male gender by 310%. The estimated number of hip fractures worldwide will rise from 1.66 million from 1990 to 6.26 million in 2050. This disease progresses fast and hence the importance of patient education. The increasing rate of hip fractures could be partly attributed to the number of increasing proportion of elderly women in the society. (Sambrook and Cooper 2006,12.)

2 OSTEOPOROSIS

Osteoporosis, like many diseases, has a general definition as well as more specific definitions by specialists in the field.
According to the national osteoporosis society (NOS), osteoporosis is a chronic disease and its clinical consequences occur late and are detected late. (WHO 1994.)

It happens silently and suddenly and its signs and symptoms are seen after a fracture has already occurred. This skeletal disorder affects osseous tissue that form bones by decreasing density and increasing brittleness and this results in compromised bone strength, which places an individual at risk of fracture. It can be defined further as systematic and also happens continuously over a given span of time. It is a skeletal disease that results in low bone mass and deterioration of the small structures in the bones. This make the bones fragile and more prone to fractures. (WHO 1994.)

Osteoporosis classification system is based on measurements of the bone mineral density of women. A woman’s actual BMD is assessed and then compared to the average peak BMD of a healthy young adult same sex and ethnicity. The woman’s deviation from this average is then calculated in standardized units. Women are considered to have a normal BMD if their score falls within 1 SD of the mean. Those whose BMD score falls within 1 to 2 SDs below the mean are classified as having osteopenia, a condition in which the bone loss is not severe enough to warrant classification as osteoporosis. The classification of osteoporosis is given to those whose BMD score is greater than or equal to 2.5 SDs below the mean. Women who have a history of fragility fractures and a BMD score greater than or equal to 2.5 SDs below the mean are classified as having severe or established osteoporosis. (Gueldner & Sarah 2007,9.)

After the third decade of life (30 years), bone naturally begins to decline at the rate of 0.3% of bone per year. By 2 years postmenopause, bone mass declines at the rate of 3% per year and 7 years after menopause bone loss slows to approximately 1% of bone per year. (Golden, H.2000, 542.)
It is a disease with subtle or gradual onset. It progresses gradually and without warning signs. It is not possible to point out a time when the symptoms began. Many people with osteoporosis do not even know it and the doctors or their health care providers have not also detected it until a fracture occurs or they have their bone mass is tested and a correct diagnosis is made. (Searle 2001,4.)

In this bone disorder the bones become porous and this results from loss of calcium in bones and as a result the bones become brittle and susceptible to breaking. It is a silent disease hence impossible to diagnose until a person suffers a fracture or a broken bone. Osteoporosis may be classified as either primary and secondary. Primary osteoporosis is age related in both genders and there is occurrence of bone loss. In primary osteoporosis, the natural lifelong process where mature bone tissue is removed from the skeleton is normal, but the process where by bone is broken down, minerals released and transfer of calcium from bone fluid to the blood is incomplete. (Skinner 2003,3.)

This type one can further be divided into two types. Type 1 also known as postmenopausal osteoporosis occurs in 5% to 20% of women, affecting those within 15 to 20 years of menopause, with a peak incidence in the 60s and early 70s. The main causative factor is estrogen deficiency and as a result the skeleton becomes more sensitive to parathyroid hormone (PTH), resulting in increased calcium resorption from bone. The ultimate result is a decreases in PTH secretion, vitamin D production, and calcium absorption and hence the occurrence of fracture and bone loss. (Daniel 1996,558.)

After the onset of menopause, women can lose an average of 2.5% of their bone per year for the first 5 years. Because of the drop in estrogen production, women lose nearly 50% of their trabecular bone and 35% of their cortical bone throughout their lifetime. (Iqbal 2000, 3.)

Type 2 is age related and is also known as senile osteoporosis and happens to individuals who are 70 years of age in both genders. Decreased bone formation along and decreased ability of the kidney to produce Calcitriol.
Calcitriol is a form of vitamin D that is used to treat and prevent low levels of calcium in the blood of patients whose kidneys or parathyroid glands are not working normally. Calcium absorption lowers as when there is vitamin D deficiency which increases the PTH level and consequently bone resorption. In type 2 osteoporosis, the risk of hip fractures is high as well. (Iqbal 2000, 3.)

Secondary osteoporosis occurs equally in men and women at any age. In men, most cases are due to disease or to drug therapy, but in most of affected individuals the cause is not known. In various series of osteoporotic patients, secondary osteoporosis accounts for about 40% of the total number of osteoporotic fractures seen by a physician. This type of osteoporosis is associated with a variety of conditions including hormonal imbalances, cancer, gastrointestinal disorders, drug use. (Iqbal 2000,3.)

2.1 Normal bone

Bone is living tissue that increases in length, weight (mass), mineral content (density), and strength during childhood and adolescence. Pregnancy marks the start of a new life and in the second month of pregnancy, bone formation begins. In the 5th week of pregnancy limb buds develop. This is followed by development of connective tissues. From the 7th week to the 6th month of uterine life there is cartilage and bone development. (Downey & Siegal, 2006.)

By the 6th month the innermost part or the central cavity of bone shafts of long bones is developed. Primary ossification centres are apparent in the middle of long bones between 6th and 16th weeks. When one is born, one has what are termed secondary ossification centres, located in the epiphyses (rounded end) of long bones. These centres appear just before birth and ossify in the late teenage years when skeletal maturity is reached. These centres allow bones to continue growing in a child after birth. During growth these areas, known as epiphyseal plates, maintain a constant thickness. (Schoen 2001,55.)
In the beginning of adulthood the cells in the plates divide less often and the plates become thinner and thinner until they are entirely made up of bone. The period when bone mass increases significantly in a human being is in adolescence years. (Gordon et al 2004).

The parathyroid hormones function is to regulate calcium homeostasis by increasing the release of calcium from bone and resorption of this from the kidneys. It plays a significant role in formation and maintenance of bone. (Downey & Siegel, 2006.)

Another endocrine function is that of the thyroid gland, which synthesises a polypeptide hormone known as calcitonin. Calcitonin has an inhibitory action on osteoclasts, thus lowering serum calcium levels (Downey & Siegel, 2006). Other hormones that influence bone growth and density include glucocorticoids, thyroid hormones and oestrogens. The average age at which maximum bone density is attained is 30 years and 50% of peak bone mass is accumulated through the adolescent years (Golden, 2003). If the body is able to reach peak bone mass during this adolescent years, the bone mass later in life can remain stable and consequently decrease the risk for osteoporosis. (Gordon et al 2004, 4.)

After the average age of peak bone mass attainment which is 30 years, there is a 1-2 % decline in bone mass each year until menopause. At this time, bone mineral density levels decrease rapidly due to low oestrogen levels and women lose up to 40% of their total bone mass after menopause. Oestrogen plays a significant role in minimising bone loss in women. This hormone works to protect the bones in three ways:

a) It suppresses osteoclastic activity and increases the number of vitamin D receptors on osteoblasts.

b) Promoting renal reabsorption of calcium and helping to promote the intestinal absorption of calcium. (Anderson et al 2005, 305.)
c) Promotes osteoblastic activity, increasing the growth of new bone and causing the thyroid gland to produce calcitonin, providing even more protection at a cellular level.

After menopause the ovaries stop functioning and this results in the absence of oestrogen which alters skeletal homeostasis. As a result postmenopausal women experience bone loss density. (Maher et al 2002, 66.)

When peak bone mass is attained the bones are at the strongest state. If the bones are strong at the formative years, there is a significant decrease for developing osteoporosis later in life, the first two years of life and the early adolescent years being the most vital. Bone gain and loss is a cycle in that the amount of bone mineral gained during adolescence equals the amount lost throughout the rest of adult life. A balanced diet is hence of utmost importance during this formative years of life. (Bailey et al 2000, 2245.)

What makes bone hard is its mineral content and bone’s mechanical strength is determined by structural protein collagen. The bones of the adult skeleton comprise two types of tissue, cortical or compact, and cancellous or spongy bone. Most bones consist of an outer cortical sheath enclosing a trabecular network of cancellous bone that houses the marrow. The cortical sheath is bounded outside and inside by the periosteal and endosteal surfaces, respectively. The endosteal surface of the cortical sheath is connected to cancellous bone and consists of interconnected rods and plates. This structure maximizes strength while minimizing weight. The rods and plates of the cancellous network are preferentially oriented along the lines of mechanical strain of the bone. In adults, 80% of the skeleton is cortical bone. (Fleisch H 1997, 11.)

However, the relative proportions of cortical and cancellous bone vary in different parts of the skeleton. For instance, in the lumbar spine, cancellous bone accounts for about 70% of the total bone tissue, whereas in the femoral neck and radial diaphysis, it accounts for about 50% and 5%. (Fleisch H 1997, 11.)
The main function of bone is to support the body and protect internal organs from injury. The process of bone renewal happens continuously is all adults and small amounts of bone are broken down and replaced by new bone known in. Bone marrow is found inside the bone and it produces large numbers of blood cells. Bone is also an essential reservoir of minerals for the body. Minerals like calcium phosphate and calcium carbonate, fluorides and chlorides are moved from other parts of the body to the bone and back again under the influence of hormones, specialised bone cells and during exercise. (Schrader, et al 2005, 55.)

The dense outermost bone is known as cortical bone while the more spongy internal form is known as cancellous or trabecular bone. Bone is categorized into four levels namely, normal bone mass, low bone mass where the BMD is lower than normal, osteoporosis in which fractures have not yet occurred and severe or established osteoporosis when fractures have occurred. (Limpaphayom et al 2001, 64.)

To further expound on this categorization of bone, normal bone means a value of BMD greater or less than one standard deviation below the peak bone mass of healthy adults. Osteopenia means a value of BMD between 1.0 SD and 2.5 SD below the average value of the peak bone of healthy adults. Osteoporosis means a value of BMD more than 2.5 SD below the average value of the peak bone mass of health adults. (Limpaphayom et al 2001, 65.)

2.2 Peak bone mass

Peak bone mass is the amount of bone tissue present at the end of skeletal maturation. It is a major determinant of the risk of fracture due to osteoporosis since the mass of bone tissue at any time during adult life is the difference between the amount accumulated at maturity and that lost with ageing.
In adolescent girls, the gain in BMD declines rapidly after menarche and is insignificant 2 years later. (Bonjour JP et al 1994,55.)

In adolescent boys, the gain in BMD or in bone mineral content is particularly rapid between the ages of 13 and 17 years but declines markedly there after in all sites except the lumbar spine and mid femur, where growth continues until the age of 20 years. However, no significant increase in BMD is observed at the femoral neck. During late puberty, when height is increasing by less than 1 cm/year, the gain in bone mass is still significant in males but not in females. This suggests an important sex difference in the magnitude and/or duration of the so-called consolidation phase that contributes to the ultimate peak bone mass. (Fournier P et al 1997,525.)

2.3 Diagnosis and screening Osteoporosis

The World Health Organization definitions of osteoporosis and osteopenia in postmenopausal is based on bone mineral density (BMD). Osteoporosis is diagnosed by carrying out a central dual-energy x-ray absorptiometry test (DXA) of the hip. This is a non invasive procedure which produces accurate results. (Kanis & Glüer 2002,192.)

Density measurement in gm/cm2, and T and Z scores are the universally recognized measurements for reporting the results. T scores represent the number of SDs from the mean bone density values in same sex matched young adults. For dual energy X-ray absorptiometry a comparison is made between soft tissue and bone penetration of two different X-ray sources. Soft tissue is then subtracted leaving an estimate of skeletal BMD. This takes less than 10 minutes, and the person is exposed to radiation about three to four mrem/site. By comparison, background radiation is about 300 mrem/year. DXA can assess various sites in the body but it recommended that BMD of the non dominant hip be assessed. It is an excellent predictor for hip fracture and an an excellent preditor of vertebral or wrist fracture. (Mc Court et al 2010,8.)
The T score is used to make a diagnosis of normal bone density. Z scores represent the number of SDs from the normal mean value for age and sex matched control subjects. If the A Z score are less than 1, the presence of secondary osteoporosis is likely. Z scores assess bone loss in premenopausal females and in men who are below 50 years of age. A Z score of −2.0 or lower is defined as below the expected range for age, a Z score above −2.0 is within the expected range for age. (Leib et al 2004,1.)

2.4 Pathophysiology of osteoporosis

Bone formation happens continuously and several factors determine how this goes on namely: Estrogen and progesterone stimulation, dietary and the amount of stress put on the bone. For bone to remain healthy, the process of bone break down and bone formation have to remain balanced. (Kowalak et al 2001,50.)

Osteoblasts are cells that continually form bony matrixes to replace areas of bone that have been digested by phagocytic cells called osteoclasts. The continual process of bone remodeling through osteoblast and osteoclast activity amounts to a preventive maintenance program allowing for a healthy skeleton (National Osteoporosis Foundation, 2006).

Any alteration during remodeling results is bone thinning or osteoporosis. For bone remodeling to remain stable, proper level of estrogens and progesterones are required. ((Hawkins et al 2005,6.)

There are two processes of bone loss. Rapid bone loss that takes place during menopause and is osteoclast mediated. Osteoclast is a large multinucleate cell found in growing bone that resorbs bony tissue, as in the formation of canals and cavities. (Finkelstein 2004.)
The other one is gradual bone loss which takes place after menopause and is osteoblast mediated. Osteoblast are mononucleate cells that are responsible for bone formation. (Finkelstein 2004.)

In a healthy adult it takes 4 months to complete one cycle of bone remodeling. In a person with osteoporosis it takes 2 years. For osteoporosis not to occur the bone remodeling process needs to occur without interruption. It takes the following steps namely: Cluster of bone precursor cell respond to stimulus which could be in the form of drugs, hormones or physical stressor to activate the remodeling process and form osteoclasts which in turn form a cutting cone and begin to resorb bone leaving a resorption cavity. In cortical bone osteoblasts line the cavity and begin laying down layers of new bone until a harversian canal results. Osteoporosis occurs if this process of remodeling is interrupted. (Monahan 2007,1579.)

Other ways that also bring about osteoporosis are a decrease in the number of bone precursor cell, a decrease in the rate of bone formation, an increase in the rate of bone resorption or an increase in the number of stimuli that activate the process and if the whole process is not completed in entireity. The bone’s vascular system should also not be interfered with. (Monahan 2007,1579.)

3 THE RISK FACTORS FOR OSTEOPOROSIS

There are many factors that increase the risk of a person developing osteoporosis. Individuals with more risk factors are at greater risk of osteoporosis and this can further be divided into non modifiable meaning that an individual has no control over them and modifiable risk factors for osteoporosis meaning the individual can make life style changes to change and control the development of osteoporosis.
3.1 Non modifiable risk factors for osteoporosis

Genetic factors account for up to 80% of the difference in peak bone mass and bone turnover as well as contributing to the occurrence of osteoporotic fractures. Parental history of osteoporotic fracture, especially a family history of hip fracture over the age of 50 years, increases an individual's risk of experiencing a fracture. (Kanis et al 2004.)

During menopause the ovaries produce lower levels of estrogen. This results in an acceleration of bone loss following menopause compared to that in the third decade. The average age at which women in the UK reach the menopause is 51 years. Premature menopause therefore results in the early acceleration of demineralisation and is a risk factor for osteoporosis in the future. Similarly, hysterectomy with bilateral oophorectomy causes instant menopause and should also be considered an increased risk for osteoporosis in pre-menopausal women. (NOS 2006)

Age and gender is another non modifiable risk factor. Bone mineral density decreases with age and therefore the risk of osteoporosis increases. There is a significant increase in the prevalence of osteoporosis at the age of 60 and for subsequent decades. Changes in age is more important than changes in bone mineral density in predicting fracture risk. Women are typically at greater risk of osteoporosis than men and this is attributed to the fact that they have smaller bones and a lower total bone mass. (SIGN 2003).

Ethnicity also plays a role in terms of bone mineral density. Afro-Caribbean women have a higher bone mineral density than Caucasian women and this factor is at any given age be it in adolescent or adulthood. They also have a higher peak bone mineral density and they lose the bone at a slower rate. (Barrett-Connor et al 2005.)

History of previous fracture. According to Nelson et al 2001, women who have had a fragility fracture are at increased risk of future fractures irrespective of bone mineral density. Adults who sustain a fracture are more than 50% more likely to have another fracture of a different type. (NOS 2006).
Similarly, women with one existing vertebral fracture have a five fold greater risk of vertebral fracture. Furthermore most post menopausal women who have had a vertebral fracture will experience a second within a year. (NOS 2006).

Those who have already fractured are at greatest risk of further fracture, including those with a thoracic kyphosis, which may be indicative of previous osteoporotic fracture. (Cummings et al 1998.)

3.2 Modifiable risk factors for osteoporosis

Smoking leads to higher incidence of fractures, decreased bone healing, a decrease in new bone formation, a decrease in mineralization of bones in the hip, hand forearm and heel. Previous smoking also results in an increased fracture risk, although the risk is lower than that of current smokers. Weight is also another modifiable risk factor. A body mass index (BMI) less than 19 is an indicator of a low bone mineral density (SIGN 2003), with those in the lowest strength of BMI having a greater risk of bone loss in comparison to those in the highest tensile. Post menopausal women with a BMI that is below average have an increased risk of osteoporosis (Ravn et al 1999).

Vitamin D plays a fundamental role in calcium absorption and over all bone health. It facilitates the intestinal absorption of filtered calcium and reabsorption of filtered calcium from the glomerular tubules within the kidneys back into the plasma. Calcium is also essential for healthy new bones and may be acquired through dietary intake or the use of supplements. Vitamin D levels positively relate to bone mineral density. (SIGN 2003.)

The impact of exercise to bone mass density is immense. During periods of prolonged bed rest, bone loss typically occurs at 1-2% per month. Physical activity can delay the progression of osteoporosis from the late 20s by slowing the rate at which bone mineral density is reduced. People who do not do any physical activity, have a greater at risk of developing osteoporosis.
When a tennis players hands are compared, the hand that the player uses to play has a higher bone mineral density and this indicates that physical activity plays a major role in the strength of bones. When balance and strength exercises are performed, the risk of falling is significantly reduced by increasing strength and flexibility. (Chang et al 2004, 532.)

3.3 Complication of osteoporosis

Once osteoporosis has occurred, fractures occur making it the most notable consequence of osteoporosis. Effects of osteoporosis happen to any bone in the body, but the most common sites of fractures are the hip, spine, and wrist (NOF, 2006). Age determines where the fracture will occur. For individuals in who are aged 50 years, fractures tend to happen at the wrist, at 60 years fractures occur at the vertebrae of the spine, and at 70 years, the occurrence is at the hip. In all this fracture sites the hip fracture is more pronounced with age. (Melton 1996, 121.)

Consequences of decreased bone mass are skeletal fractures and other complications related to bone loss. This complications are abdominal protrusion, height loss, and kyphosis secondary to multiple vertebral fractures, acute and chronic pain resulting from fractures, decreased respiratory capacity, and increased morbidity and mortality rates. Quality of life diminishes as a result of this complications. The pain associated with this fractures is also immense and the affected are bound to suffer loss of self esteem. (Maxwell & Viale 2005, 589.)

Death from hip fractures are also inevitable and this deaths can occur within a year of sustaining a fracture. After sustaining hip fractures carrying out daily activities is no longer possible and the individuals have to be helped to do what they were able to do. This adds to the burden of increased health care costs because long term home or hospital care is needed. Back pain, loss of height, depression, and low self-esteem are also complication of this disease. (Brown et al 2006, 95.)
The burden of this disease continues after the patient has been discharged from the hospital so it becomes a life time burden for the patient and her family. (Brown et al 2006,95.)

It is expensive to diagnose and manage osteoporosis and more so if surgical intervention are sought or when acute episodes occur. The patients and family members have to make lifestyle adjustments due to the financial and psychological impact. (WHO, 2003.)

The cost of osteoporosis is both direct and indirect. Direct costs include hospital costs incurred during treatment. Indirect costs are patient’s loss of income, loss of a job and adjustments in the household. Intangible costs that cannot be quantified in monetary units are when the patient become immobile, costs in relation to human suffering, death, reduced productivity as well as health care costs (Ribeiro et al, 2000).

Occurrence of death within the first year of sustaining hip fracture is up to 25%. If survival occurs beyond a year, long-term institutional care is required. Caring for an elderly person who is also affected with osteoporosis affects the direct costs of managing osteoporosis related fractures. The costs of hip fractures are twice as high in the elderly than in younger patients. (Berarducci et al. 2002,19.)

4 TREATMENT AND PREVENTION

Early and effective interventions are necessary to reduce the risk of future fracture. It is vital to consider what kind of information is relevant for the various age groups in order for them to prevent or manage osteoporosis at different times in their life. For example, school age, post menopausal or older age.

4.1 Nonpharmacological interventions

Eating a balanced diet that includes adequate calcium and vitamin D, using supplements when necessary, engage in regular physical activity, avoid heavy alcohol consumption, and refraining from smoking is a good way to prevent
osteoarthritis. Glucocorticoid-induced osteoporosis prevention. Minimize exposure to glucocorticoid by using the lowest effective daily dose for the shortest period. When possible, use inhaled or topical rather than oral preparations, although high dose inhaled steroids have also been shown to cause bone loss. (Mc Court et al 2010,8.)

Every other day dosing has not been shown superior to daily dosing with respect to bone loss. Consider preventive therapy for any patient taking glucocorticoids, regardless of dose or duration: For patients taking lower doses for shorter durations (e.g., prednisone less than 5 mg daily for fewer than 3 months), who have no history of bone loss, calcium and vitamin D supplementation is recommended. For those with pre-existing bone loss, bisphosphonate therapy is recommended. (Mc Court et al 2010,8.)

For higher doses of glucocorticoids that is prednisone more than 7.5 mg daily for longer than 6 months, bisphosphonates should be prescribed as they have been shown to prevent glucocorticoid related bone loss at both the lumbar spine and femoral neck, and to reduce the risk of vertebral fractures. A large number of substances have been used to treat osteoporosis, and the patterns of use vary greatly from country to country. For example, fluoride is widely used in Germany, but is not licensed to use in United Kingdom or USA. Calcitonine is mainly used in Japan and USA. The choice of agent will depend not only on effectiveness but also on other considerations such as side effects, cost and availability. (WHO,2003.)

Intake of calcium and vitamin D is necessary to decrease bone deterioration. Ninety nine percent of the body’s calcium stores are contained in the skeleton. When an exogenous calcium supply is inadequate, the body draws from the stores to maintain serum calcium levels. (National Osteoporosis Foundation.)

Calcium supplements decrease the amount of calcium drawn from the bone to replace the exogenous supply. A daily dose of 1,200 mg per day is recommended. (National Osteoporosis Foundation.)
Vitamin D (400–800 IU per day recommended) facilitates the process by helping the body to absorb the calcium from the intestine and use it in the bloodstream. It also assists the kidneys to resorb calcium that otherwise would be excreted. (National Osteoporosis Foundation.)

Weight-bearing exercise effectively increases bone density at the lumbar spine and hip in postmenopausal women and helps bones become stronger and denser. Weight-bearing exercises, during which muscles and bones work against gravity, and resistance exercises to improve muscle mass and strengthen bone are important for building and maintaining bone mass and density (National Osteoporosis Foundation.) Weight-bearing exercises in are walking, aerobics, and resistance exercises. Exercise is also important in increasing muscle mass and strength and improving balance and coordination. (Taafe et al 2009,1208.)

Physical therapy can also be incorporated to improve strength and balance. Medications that may interfere with an individual's mental status and movement stability should be avoided. Elimination of environmental hazards in the home is also of utmost importance. (Hughes et al 2004,291.)

4.2 Pharmacological interventions.

Pharmacological therapy aims at is to reducing the risk of future fracture, and also increasing bone density. Pharmacological agents for treatment of osteoporosis fall into 1 of 2 categories: antiresorptive agents or anabolic agents. All the currently available drugs except teriparatide are antiresorptive agents. These agents reduce bone resorption more than promote bone formation and thereby suppress bone turnover and loss, whereas anabolic agents stimulate bone formation more than reduce bone resorption. (Marcus et al 2002,16.)

Bisphosphonates block bone resorption by inhibiting osteoclast activity. The bisphophonates that are currently FDA approved for osteoporosis treatment and prevention are alendronate, risedronate, and ibandronate bisphosphonates. (Griffith et al 2002,570.)
These agents significantly reduce vertebral and hip fractures by half in postmenopausal women. For all oral bisphosphonates, patients should take each tablet with 6 to 8 ounces of plain water first thing in the morning and at least 30 minutes before ingesting the first meal, beverage, or medication of the day. Patients should not remain upright for at least 30 minutes (60 minutes with ibandronate) to reduce the potential for esophageal injury. (Griffith et al 2002,570.)

Raloxifene is a selective estrogen receptor modulator that is used for both the prevention and the treatment of postmenopausal osteoporosis. It selectively inhibits or stimulates estrogen like action in various tissues. For example exerting an estrogen agonist effect in some areas e.g bone and lipid metabolism, while acting as an estrogen antagonist in others e.g breast and uterus. The dosage used is of 60 mg/d and it is known to decrease vertebral fractures by half. (Ettinger et al 1999,637.)

Another pharmacological intervention is the use of salmon calcitonin nasal spray. It is FDA approved for treatment of osteoporosis. The approved dosage is 200 IU every day in alternating nostrils. It inhibits bone resorption, which is the process by which osteoclasts break down bone and release the minerals, resulting in a transfer of calcium from bone fluid to the blood and this results in the prevention of bone loss and vertebral fractures and decreases pain that is associated with acute or subacute vertebral fractures. Compared with other treatments, it has low potency and it is therefore prescribed to osteoporotic women who are unwilling or unable to take other osteoporosis agents. It's side effect is mild to moderate rhinitis which is nasal congestion, discharge, or sneezing. (Chesnut 2000,267.)

Teriparatide is another drug used for treatment of osteoporosis. It increases bone density and reduces both vertebral and non vertebral fractures by over half. It has a great advantage in that 18 months after discontinuing treatment the reduction in vertebral fracture risk continues.
It is given in a daily dosage of 20-μg subcutaneously for a maximum duration of 2 years. It is recommended for individuals at high risk for fractures (T scores less than –3.5), even in the absence of pre-existing fracture. It is an alternative for patients who are unable to tolerate oral bisphosphonates. (Lindsay R et al 2004,164.)

Another prevention option is estrogen or hormone therapy. The dosage should be as low as possible and the duration of time used should also be short. According to some experts estrogen therapy is still the first line therapy for osteoporosis prevention in younger women with surgical menopause who have no contraindications to its use. In the immediate postmenopausal years the short term use is five to seven years for prevention of osteoporosis and often for the treatment of hot flashes in women who have no contraindications to its use. (Cauley et al 2003,1731.)

Long term estrogen based therapy use is discouraged because of an increase risk of adverse health outcomes, such as stroke and venous thromboembolic events. Breast cancer risk is likely but to a smaller degree in women receiving combined estrogen progestin therapy. Combination therapy is another treatment option that is recommended for patients who have severe osteoporosis. It is started by a bone specialist and he should monitor it closely. Risedronate and alendronate, as well as calcitonin, increase BMD when combined with hormone replacement therapy. (Ettinger et al 2004,746.)

5 PURPOSE AND AIM

The purpose of this thesis is to provide patient education on prevention of osteoporosis in menopause. The aim of this thesis is to produce information in terveys netti (health web) and create webpages that can be used by the general public to access information on this silent killing disease.
6 IMPLICATION OF THE PROJECT TASK

The expected outcome of this project is to produce webpages for Terveysnetti. Terveysnetti is an online public health education webpage created by the Salo District Health Centre, Salo District Hospital and the Salo Local government with the cooperation of Turku University students.

The main purpose of Terveysnetti is to provide health education with the sole aim of improving the health of general population hence empowering them with essential knowledge. The contents of this thesis provides exactly that and with easy access.

The contents of this bachelor thesis will provide information to premenopausal women. Men are also encouraged to seek information from this bachelor thesis as well because in most cases it's a spouse who is undergoing this changes. The general population also needs this information because this are inevitable changes that will happen to every women.

7 HEALTH EDUCATION

WHO defined health education as consisting of consciously constructed opportunities for learning involving some form of communication designed to improve health literacy, including improving knowledge, and developing life skills which are conducive to individual and community health. (WHO, 2003.)

This chapter is meant to produce information about the health education. Education is essential for patient with osteoporosis due to its silent nature and sudden occurrence of fractures. Health education can reduce anxiety and fear of the future. Once people are equipped with knowledge about the disease they
are able to make good choices about health related behaviours. (Laslett et al 2004,121)

Many women are concerned with prevention measures but the levels of their knowledge and self efficacy are low. (Phillipov 1998,582-556). Impacting knowledge in the risk factors and how to avoid them while there are factors that are not within the control of the patient. Among non modifiable factors are previous minimal trauma fracture, age , family history, female gender and early menopause. (Evidence to Support the National Action Plan for Osteoarthritis, Rheumatoid Arthritis and Osteoporosis,2004.)

The components of education strategies could be in form of:

a) Increasing knowledge about osteoporosis.

b) Increasing self efficacy.

Osteoporosis education programs should incorporate a wide age group that is from adolescents to premenopausal women and postmenopausal women because all this group of people are prone to develop osteoporosis. Those at lower risk of osteoporosis may benefit once education is availed because they can include health related behaviours . Older people at higher risk can gain confidence in ensuring treatment or prevention options that may be suitable for them. (Lorig et al 1999,5-14)

When giving health education for osteoporosis is BMD testing should be encouraged for all women aged 65 and older due to their high risk of osteoporosis and fractures. Encourage people to maintain peak bone mass because entering adulthood with low peak bone mass poses a great risk of developing osteoporosis and associated fractures . (Hansen et al 1991.)

Encourage people to do exercise regularly and more so resistance and impact exercises and to start it early in life because this contributes to higher peak bone mass. In postmenopausal women, BMD at the spine can be positively affected by aerobics, resistance, and weight-bearing exercise. Encourage setting of personal goals that are both short term and long term.
These goals are specific, measurable, attainable, relevant and time based. (Kelly et al 2002,599.)

A specific short term goal may be to start strength training. The long-term goal may be easing the symptoms of osteoporosis or increasing bone density to help combat osteoporosis, improving balance, or controlling your weight. This goal is easily measurable and attainable as long as your doctor approves, and this goal is certainly relevant to living a long healthy life. The goals should be time-based. (Centers for Disease Control and Prevention, 2011.)

Letting the women know about osteoporosis pathology and bone anatomy. Encourage family planning and increase awareness as well because women lose a lot of calcium during lactation and do not replace it in adequate amounts. An effective family planning programme could therefore go a long way in the prevention of osteoporosis. Women with more children to take care of could also be nutritionally deprived in underprivileged circumstances, and have little time and resources to consume a calcium-rich diet or engage in bone strengthening exercises. (Mc Cable et al 2004,1066.)

Encourage use of calcium rich food at least four times a week to ensure that the bones are well mineralized and attainment of peak bone mass. For postmenopausal women, calcium supplements slow bone loss and improve BMD. Dairy products are a good source of calcium and increases BMD. (Mc Cable et al 2004,1066.)

Discourage use of all forms of smoking tobacco as well as use of smokeless tobacco. There is direct relationship between tobacco use and decreased bone density. Smoking has been shown to decrease calcium absorption. Women who smoke also tend to have an earlier menopause than nonsmokers because they tend to produce less estrogen. (Eustice 2006,1.)

High risk individuals should be screened and identified and this depends on the clinical situation for example how severe the fractures are. Central DXA scans may be repeated in 1 to 3 years. (Khan et al 2002,1142.)
This is monitors the response to a pharmacologic therapy or to document the stability of bone density in untreated patients at risk for bone loss and to improve adherence to therapy. (Khan et al 2002,1142.)

Corticosteroid induced osteoporosis should be avoided because they affect calcium and bone metabolism in many ways. They decrease the amount of calcium absorbed by the intestine and they also increase calcium excretion through the kidneys. These in turn produce a decline in the circulating ionized calcium concentration. (Leufkens, et al 2000,993.)

This makes the parathyroid glands to be over active and this increases the secretion of parathyroid hormone (PTH), and the patient suffers from secondary hyperparathyroidism. Once the PTH levels are high bone breakdown is increases , as the body attempts to rectify low circulating calcium levels by releasing calcium from the bones into the blood. Corticosteroids also decrease the levels of the sex hormones, estrogen in women and testosterone in men and bone loss increases . Muscle weakness is also another side effect of corticosteroids and due to the inactivity that comes about and bone loss occurs. Direct impact that is associated with corticosteroids is suppression of bone formation . (Leufkens, et al 2000,993.)

Develop awareness of the risks of excessive alcohol intake. Chronic alcohol use has been linked to an increase in fractures of the hip, spine, and wrist. Too much alcohol interferes with the balance of calcium in the body. It also affects the production of hormones, which have a protective effect on bone and of vitamins, which are needed to absorb calcium. Excessive alcohol use can also lead to slips and falls. (Eustice 2006,1.)

Treatment of osteoporosis has had limited success. Prevention is preferable to treatment, since no therapy fully restores lost bone mass. Prevention is a more useful approach, and ideally, women at high risk should be identified before menopause when preventive measures can be instituted. Whether single measurements of bone density in women who are at risk can identify those who should be treated is a point of controversy. (Cummings 1986,820.)
8 ESTABLISHING WEBPAGES

In today's world, the widely and most common medium of accessing information is through webpages. This is due to easy accessibility at any time and any location. Designing webpages is also important in order to reach the target population. Establishing webpages begins by preparing the contents. All the information that is going to be provided come from researched articles and books. Webpages encourage the passing out of quality health information for patients and professionals and the general public and by so doing the above mentioned/ targeted population are able to access the most recent and relevant health information. (HONcode)

The target group are mostly adolescent women in preparation for their menopause stage of life but also useful for the men. In creating this webpage, content of the webpage is well organized and the flow of information is perfectly clear. The language construction is simple so that uneducated target groups can benefit. Useful links were provided from several parts of the world for further information and guidelines. While designing the webpage comfortability of both educated and non educated group was made priority.

The information that will be provided in the webpages will be a summary of the whole bachelor thesis and what is contained in the bachelor thesis is information from researched articles, read through and finally analysed. The information provided is intended for patient education and hence the webpages will be designed to do exactly that and it will be simple and easy to understand.

9 RELIABILITY

In the process of getting relevant information about the topic of this bachelor thesis, literature review was used. The reasons for using this method is that with some modification of the original literature, it becomes legitimate and publishable. It is an information analysis and synthesis, focusing on findings and summarizing the substance of a literature and drawing conclusions from it. (Boote & Beille 2005,5.)
All the materials used in this thesis were collected from health care database and books. The materials were considered and accepted as valid and reliable. Biased and personal opinions were not used with literature review. Reasonable number of searches were used to provide enough information and to support the teaching. However the topic was approved by my supervisors before proceeding and continuous checks are done on it until this stage to make sure it is close to perfection.

The articles selected were reliable because they had all the information on prevention of osteoporosis in menopause. Reliable articles were identified from different databases namely, Cinahl, Science direct and books from the school library. The same procedure was followed in each database. The articles were read thoroughly in order to identify their relevance in terms of content and the results obtained. In the process of finding relevant material for this bachelor thesis, several searches have been done and with changing and using different search words all related to the thesis topic. The searches were conducted using several words as my appendix shows. After searching two words, a combination with or and later with and yielded several results.

The end result was 30 articles of which 16 were full text. Most of them did not have relevant material hence another search was conducted using two words. Osteoporosis and menopause. The search was limited year 1998 - 2010 with the exception of ones that was done in the year year below 1998 owing to their very relevant material.

The articles were read through and several articles were picked to be used in the literature review owing to their relevance in the topic on osteoporosis. Science direct and Cinahl were used. To get final and relevant articles, the use of the preventing osteoporosis in menopause as a search term was preferred. In the process of carrying out literature review plagiarism was avoided and this was achieved by understanding the text and wording it differently without changing the meaning and that is vital in ethical consideration.
All the articles were searched from recognized search tool as indicated above and all were professional, peer-reviewed scientific journals. Ethical consideration

10 ETHICAL CONSIDERATION

In the process of carrying out literature review plagiarism was avoided and this was achieved by understanding the text and wording it differently without changing the meaning. All the articles were searched from recognized search tools as indicated above and all were professional peer reviewed scientific journals. Formal language was used and not forgetting that this is a continuing situation or disease in that the information on prevention was true in the past, is true presently and will be true in the future. Only medical interventions might change.

11 CONCLUSION

Regular physical activity, healthy eating and not smoking can prevent and alleviate problems associated with age-related loss of muscle strength and bone density. Policies and programmes need to dispel misconceptions about the menopausal period and encourage ageing women to adopt healthy lifestyle behaviours that will help them cope with the physical symptoms of menopause and bone loss. (WHO, 2007)

However, osteoporosis should no longer be considered an old women's disease but rather young women should also be included. It should be viewed as a life long concern and special attention should be given to adolescent years. Up to 95% of total bone development is completed before the age of 18. Women's bone strength depends upon this period of rapid growth and the skeletal mass achieved during the first two decades of life. (Cavadin et al, 2000, 18.)
Any factors adversely impacting bone acquisition during adolescence have the potential to yield long term detrimental effects. Caregivers should address factors affecting bone health when giving patient education to adolescents in order to promote bone growth and adult peak bone mass. When addressing osteoporosis prevention in adolescent's the educator must establish the adolescent's knowledge of bone health and establish their dietary patterns. (Cavadin et al 2000, 18.)

Osteoporosis is a health problem that has an impact on people's health globally. The most important years for bone development are during adolescence. Challenges and threats during this formative years result in negative health outcomes later on in life. The decisions and actions decided upon by adolescents will influence their lives in later years. This age group should be a target in the management of health-related issues. Health promotion strategies are needed to address this age group order to achieve positive outcomes later in life. (Cadogan et al 1997, 1255.)

Many women are not diagnosed with osteoporosis until they have sustained one or more fractures, despite advances in diagnosis and therapeutic interventions. Priority should be directed towards finding and managing patients who have the highest risk of falling and experiencing fracture (SIGN 2003). Falls are a significant risk factor for fractures and therefore the assessment and management of the risk of falling are as important as treating osteoporosis. The risk factors associated with falls increase with age, resulting in an increased frequency of falls. As many older people do not seek advice following a fall, it is important to actively seek the history of falls during consultations. Falls assessments should be comprehensive. Advocate the use of multifaceted interventions to reduce the incidence of falls in older people, such as gait training, use of assistive devices and exercise. (The American geriatrics Society 2001.)
Finally the webpages contain valuable information that the general public will have access to. The information that will be provided in the webpages will be a summary of the whole bachelor thesis and what is contained in the bachelor thesis is information from researched articles, read through and finally analysed. The information provided is intended for patient education and hence the webpages will be designed to do exactly that and it will be simple and easy to understand.
SOURCE MATERIAL


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