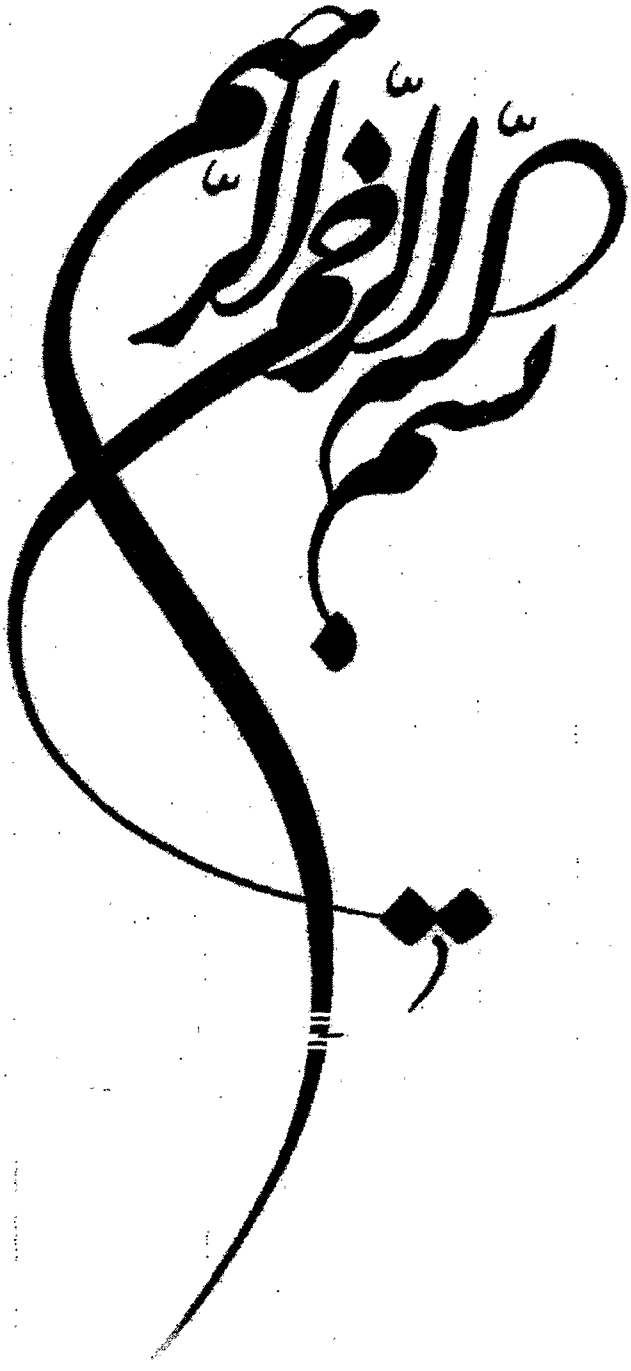

Shiraz University of Medical Sciences
School of Dental Medicine

Thesis for the Partial Fulfillment of
The Master of Sciences in Oromaxillofacial Radiology

Evaluation of efficiency of panoramic mandibular index (PMI) in the diagnosis of osteoporosis in women reffered to BMD department of Shiraz Namazee Hospital in 2002-2003

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دانشگاه علوم پزشکی شیراز

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پایان نامه جهت دریافت درجهٔ دکترای تخصصی در رشته رادیولوژی دهان و فک و صورت

عنوان :

بررسی کارآیی شاخص پانورامیک فک پائینی (PMI) در تشخیص استئوپروز در زنان مراجعه کننده به بخش چگالی سنجی (Densitometry) بیمارستان نمازی شیراز در سال ۸۳-۱۳۸۲

استاد راهنما :

سرکار خانم دکتر لیلا خجسته پور

استادیار بخش رادیولوژی دهان و فک و صورت

استاد مشاور :

سرکار خانم دکتر شعله شهیدی

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Evaluation of efficiency of panoramic mandibular index (PMI) in the diagnosis of osteoporosis in women reffered to BMD department of Shiraz Namazee Hospital in 2002-2003.

Introduction

Osteoporosis is a systemic skeletal disease, characterized by low bone mass and microarchitectural deterioration of the bone scaffold that result in increased bone fragility and susceptibility to fracture. It is one of the most common disorders of the elderly and is estimated to effect 75 million people in Europe, Japan and the USA. The purpose of screening for osteoporosis is to identify individuals who are likely to benefit from treatment. [1]

Osteoporotic fractures occur mainly in the vertebra, radius and proximal femur. Since bone fragility is mainly dependent on bone mass [2] in order to predict the fracture risk, bone mass or bone mineral density (BMD) has been measured by several bone measurement techniques, including single or dual photon absorptiometry (SPA or DPA), quantitative computed tomography [3](QCT), single or dual X-Ray absorptiometry [4] (SXA or DXA or DEXA), and quantitative ultrasound [5] (QUS). However, the availability of these techniques is still too limited to be able to identify more than a small proportion of those women with osteoporosis.

The fact that most of the adult visits their dentist annually and that dentists often make radiographs of the jaws, makes dentists a potentially valuable resource for patient screening for signs of osteoporosis. Several lines of work have demonstrated that individuals with osteoporosis have altered the morphology of the mandible[1,6,7]. Specifically, resorption and thinning of the inferior border of the mandible has been correlated to low hip and spine bone mineral

density (BMD). Dentists identifying patients with clinical and radiographic risk factors associated with low bone mass, could make appropriate refferals for diagnosis and management[7].

As it is very difficult to treat a spinal fracture, once it has occurred and progressed in latent osteoporotic patients, the importance of identifying precursive signs of spinal fracture is apparent. However, there are technologic barriers that limit the measurement of BMD in the mass screening for osteoporosis.[7]

Consequently, we decided to study the capability and usefulness of panoramic radiography and compare it with bone mineral densitometry (BMD), in evaluation of osteoporosis.

Review of literature

Bone structure and physiology:

Bone consists of an organic matrix that is mineralized with calcium and phosphate. There are two types of bone: cortical and trabecular Bone.

Cortical or compact bone forms the outer surface of the skeleton. It makes up the shafts of the long bone, including the proximal femur.

Trabecular bone sometimes reffered to as cancellous, spongy, or medullary bone. One forms the internal aspects of the skeleton. [8]

Bone structure is affected by alterations in calcium and phosphorus metabolism. In the normal state both serum calcium and serum phosphorus levels are relatively constant and controlled by the action of several hormones. Alterations in that hormone mineral metabolism may lead to a loss of bone structure.Well-known examples of metabolic bone loss are hyperparathyroidism, postmenopausal osteoporosis and hypercortisonism. [9]

The skeleton reaches its peak mass about age 35. Bone mass is approximately 30 percent higher in men than women. [8]

After peak bone mass has been obtained, it is normal for bone mass to decrease through out life because of an imbalance in remodeling. These bones however maintain their basic organization by loss of both the mineral and organic matrix components. Compact cortical bone becomes progressively more porous while medullary bone becomes less dense , and the trabeculations within the medullary bone may

disappear. Fifty percent of men exhibit cortical bone loss by age 80, among women 50% show cortical bone loss by age 70 and 100% by age 90.

Trabecular bone is affected earlier than cortical bone, and vertebral column is the prime site of involvement.

In 55 years of age and older, the situation is reversed and cortical bone is affected more significantly[10].

Osteoporosis

Osteoporosis is the most common metabolic disease characterized by low bone mass and microarchitectural deterioration with a consequent increase in bone fragility with susceptibility to fracture.[11] Fig. 1 and 2

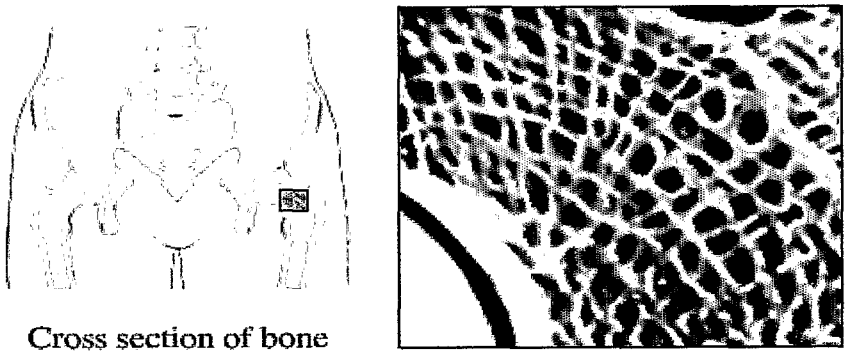

Fig. 1: Dense, strong bone matrix

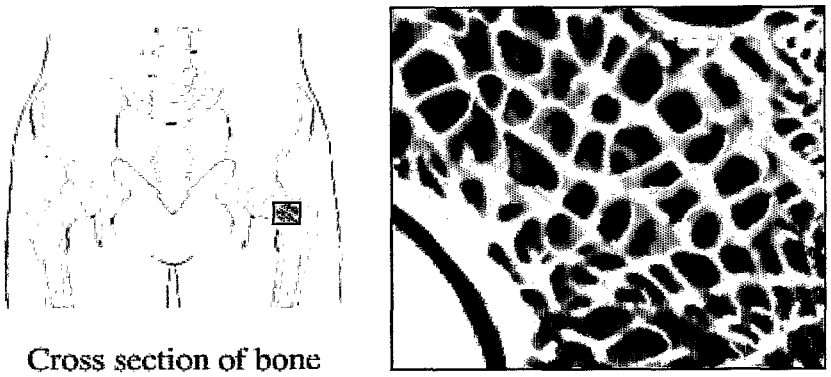

Fig. 2: Porous, damaged bone matrix

It is one of the most common disorders of the elderly and is estimated to effect 75 million people in Europe , Japan and the USA. There are over 1.5 million fractures each year in the US: 20% hip, 45% vertebra, 15%wrist, and 20% other fractures. Most fractures result from falls.

In adulthood the rate of fractures increases first in women and later in men. This is consistent with the earlier loss of bone in women compared with men. [1]

Hip fractures are especially serious, as 12-20% of all hip fracture, patients die within the first year after the fracture, and 36% of women and 48% of men die within 2 years.[13] (Fig. 3)

Of those who survive, half do not regain their prefracture level of independence.[12,14,15]

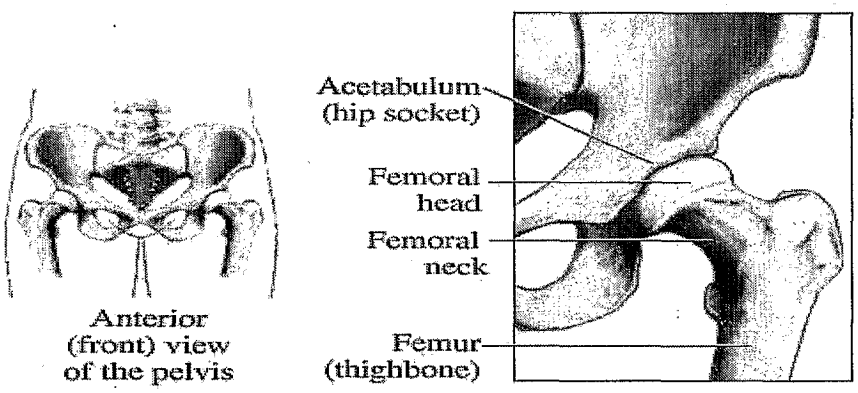

Fig. 3: Anterior (front) view of the pelvis

Internationally it is estimated that in 1990 hip fractures affected about 560000 individuals in Europe, 360000 in North America and

570000 in Asia [16] . These numbers are expected to be quadrupled by 2050.

Osteoporosis has been divided into several classifications according to etiology and localization in the skeleton. Ostoporosis, initially is divided into localized and generalized categories. These two main categories are classified further into primary and secondary osteoporosis[17,18,19,20].

Primary osteoporosis occurs in patients in whom a secondary cause of osteoporosis cannot be identified, including juvenile and idiopathic (type I and type II)osteoporosis.

Juvenile osteoporosis

- This condition usually occurs in children or young adults of both sexes.
- These patients have normal gonadal function. The age of onset usually is 8-14 years.
- The hallmark characteristic of juvenile osteoporosis is abrupt bone pain and/or a fracture following trauma.

Type I osteoporosis (postmenopausal osteoporosis)

- This condition occurs in women aged 50-65 years.
- This type of osteoporosis is characterized by a phase of accelerated bone loss.

- This bone loss occurs primarily from trabecular bone. In this phase, fractures of the distal forearm and vertebral bodies are common.

Type II osteoporosis (age-associated or senile)

- This condition occurs in both women and men older than 70 years.
- This form of osteoporosis represents bone loss associated with aging. Fractures comprise both cortical and trabecular bone.
- In addition to wrist and vertebral fractures, hip fractures often are seen in type II osteoporosis.

Secodary osteoporosis

- Secondary osteoporosis occurs when an underly disease causes osteoporosis. This secondary classification includes metabolic disease, connective tissue disease, bone marrow disease immobilization , and drug use. Even the clinical history may not be completely revealing , as a patient with known metastatic disease can develop compression fractures from osteoporosis secondary to chemotherapy or administration of steroids, and radiation therapy can weaken the bone.

Secondary causes of osteoporosis

Genetic (congenital)	Osteogenesis imperfecta gonadal dysgenesis
	Turner syndrome Klinefelter syndrome Hypophosphatasia Homocystinuria Mucopolysaccharidosis Gaucher disease Sickle-cell anemia Thalassemia Hemophilia
Endocrine	Hyperthyrodisim Hyperparathyroidism Cushing syndrome Acromegaly Estrogen deficiency Hypogonadism Diabetes mellius Pregnancy
Deficiency states	Scurvy Malnutrition Anorexia nervosa Protein deficiency Alcoholism Liver disease
Neoplastic	Myeloma Leukemia Lymphoma Metastatic disease
Iatrogenic	Heparin –induced Steroid –induced Dilantin-induced
Miscellaneous	Amyloidosis Ochronosis Immobility Weightlessness

Thoracic spine fractures present as wedging or compression fractures, whereas lumbar spine fractures are characterized by a biconcave fracture pattern.[20] (Fig.4 and 5)

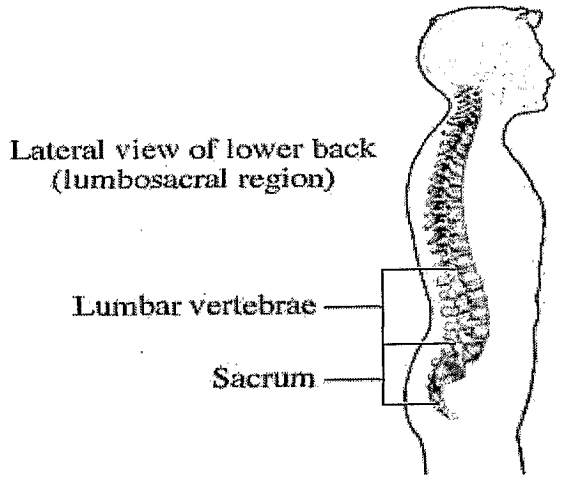

Fig. 4: Lateral view of lower back (Lumbosacral region)

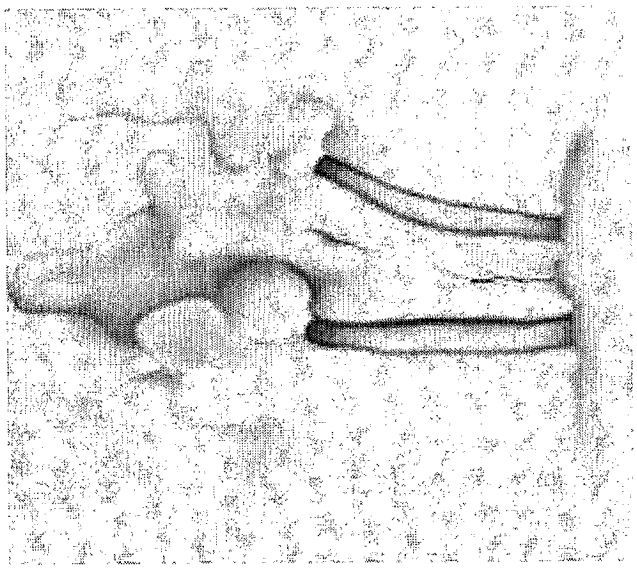

Fig. 5: Vertebral fracture

Suggestions have been made that panoramic radiographs that show progressive periodontal disease,[21] alveolar bone resorption [22], tooth loss[23], and endosteal resorption of the mandibular inferior cortex [24], may indicate general osteoporosis.

Osteoporosis affects women to a greater degree than men specially postmenopausally.(Fig. 6)

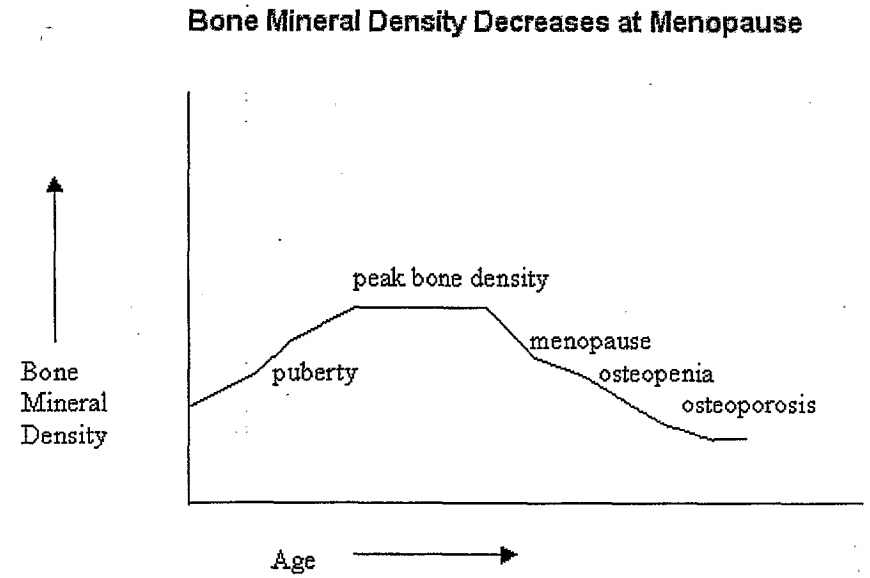

Fig. 6: **Bone mineral density decreases at menopause**

Whites are affected to larger extent than blacks. Trabecular bone is affected more than cortical bone. Therefore, the axial skeleton is affected more than peripheral skeleton. [25] (Fig. 7 and 8)

Fig. 7: Image of Pelvis

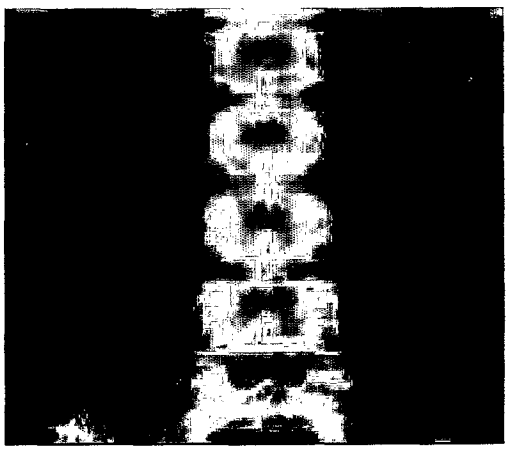

Fig. 8 : Image of vertebrae

Cancellous bone changes are even more difficult to assess than cortical changes. Osteoporosis dose not alter significantly the characteristic "step ladder" pattern of trabeculae commonly seen in normal alveolar bone.[19]

WHO has established the following definitions of osteoporosis based on bone mass density measurements in white women:

Normal –Bone density no lower than 1 standard deviation (SD) below the mean, for young adult women (T-score above-1)

Low bone mass (osteopenia)–Bone density 1.0-2.5 SD below the mean, for young adult women (T-score between –1 and –2,5)

Osteoporosis –Bone density 2.5 SD or more below the normal mean, for young adult females (T-score at or below –2.5)

Severe osteoporosis- Bone dentisty 2.5 SD or more below the normal mean, for young adult women, and presence of fracture.

Risk factors of osteoporosis[26]:

Risk factors include the following:

- Advanced age
- Female sex
- White race
- Asian ethnicity
- Family history of osteoporosis
- Small body frame
- Amenorrhea
- Late menarche
- Early menopause
- Physical inactivity