Original Article

Osteoporosis

Cortical Changes in Orthopantomogram (OPG) of Human Mandible as Early Detector of Osteoporosis

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ABSTRACT

Objectives: To see whether the cortex of mandible on an OPG can be employed for early detection and screening tool for osteoporosis.

Study Design: Cross sectional study.

Place and Duration of Study: The study was conducted in IBMS, DUHS Karachi and stretched over a period of eight months from December 2011 to July 2012.

Materials and Methods: One hundred and seventy four female subjects, aged 25 to 85 years, were divided into premenopausal (Group I) and postmenopausal (Group II) groups. Each group was subdivided into normal (pre A, post A), osteopenic (pre B, post B) and osteoporotic (pre C, post C) groups by Dual Energy X- ray Absorptiometry (DXA) Scan. Mandibular morphological changes seen on OPG in subgroups of Group I were compared with each other and with subgroups of Group II. Cortical thickness at mental foramen (CMF) was observed on OPG. Statistical analysis was performed by SPSS version 16 using One Way Analysis Of Variance (ANOVA) to evaluate intra group significance and for intergroup significance independent samples T-test was applied.

Results: The thickness of Mandibular cortex at mental foramen (CMF) was found to be significantly decreased in osteoporotic patients.

Conclusion: In conclusion a simple method of screening was established which can be used as early detector of osteoporosis in a cost effective manner.

Key Words: Osteopenia, Osteoporosis, Premenopausal, Postmenopausal, Orthopantomogram, Dual energy x-ray Absorptiometry, Mandible, Femur, Spine.

INTRODUCTION

Osteoporosis is a disease involving bone tissue, characterized by low consistency of bone mass per unit volume therefore altering the microstructure rendering them weak and fragile with great risk for fractures.[1]Osteoporosis is very commonly seen in people with low peak bone mass, less bone deposition in the process of remodeling and greater bone resorption. The underlying cause of osteoporosis is the disturbance in the normal mechanism of bone resorption by the osteoclasts and bone deposition by the osteoblasts. [2] Osteoporotic fragility fractures are those which take place with minimal injury where otherwise a normal bone will not break. The most common sites of such fractures are vertebral column, hip and wrist.[3]

There are a number of risk factors for osteoporosis.[2] Natural drop in estrogen levels in females in perimenopausal and menopausal ages are known to be associated with decreased bone mass making them more prone to bone pain, deformity and osteoporotic fractures hence increasing the fracture incidence. There are multiple factors responsible for high prevalence of osteoporosis in our part of the world. Lack of nutrition, education, finances and primary health care are worth mentioning. This is high time that government, media and medical communities should go hand in hand to create awareness about risk factors, prevention and treatment of osteoporosis in the society.

Osteoporosis is one of the few diseases that share equal concerns in both medical and dental communities.[4] Information gathered clinically is regarded as important as panoramic radiographs.[5] Work done on rats considering it as a postmenopausal model after ovariectomy, some researchers are in favor of positive correlation between osteoporosis and jawbone while others are against it.[6-10]

Establishing the relationship between mandibular changes on panoramic view and BMD of calcaneus, general changes in the mineralization of these bones were seen, which were characteristic of the postmenopausal period.[11] Factors effecting both the trabecular and cortical bones were also studied.[12, 13] In a study conducted to see the correlation between mandible and femur using quantitative computed tomography (QCT), best correlation was seen in cortical bone area of both. In these ovariectomised rat models loss of both trabecular as well as cortical tissue was seen, when compared with systemic bones.[14] Radiomorphometric analysis of mandibular bone structure after ovariectomy in mature cynomolgus monkeys, showed significant difference in bone mineral density of mandibular body, some parameters of skeletal continuity and cortical bone width. It was

suggested that the morphological changes in the cortical bone are most useful as parameters for diagnosis of osteoporosis in the mandibular body region.[15].

MATERIALS AND METHODS

One hundred and seventy four females between ages 25 and 85 were randomly selected amongst females visiting Dow Radiology, their attendants, volunteers, patients from dental and orthopedic out patient department (OPD), Ojha campus and patients from dental OPD Patel Hospital. This was a cross sectional study with consecutive sampling technique conducted between Dec 2011 to July 2012.

Subjects were asked to sign a consent form and information sheet. Simultaneously, a proforma regarding subject's history was filled by the researcher, on the basis of which they were divided into premenopausal (Group I) and postmenopausal (Group II). Group I included 85 females while Group II included 89 females. DXA Scan was then performed at Dow Radiology on the basis of which the females were subdivided into normal (pre A, post A), osteopenic (pre B, post B) and osteoporotic (pre C, post C) groups. Patients were then taken to Patel Hospital for OPG X-Ray (as this facility was not available at DUHS).

OPG X-rays were then studied for thickness of cortex at mental foramen at Zoom factor ×0.84. Software K-Pacs- Lite was used to measure the required parameter. All measurements were taken bilaterally and the mean of the two was put to statistical analysis. Intra observer and inter observer analysis gave a difference of just 0.5mm. Cortical thickness at mental foramen (CMF) was then measured by drawing a perpendicular from the line or tangent along the inferior border at the level of mental foramen corresponding to second premolar tooth.[5]

RESULTS

Intragroup comparisons were done between subgroups of Group I and subgroups of Group II to evaluate changes that occur because of osteoporosis. Intergroup comparisons were done between Group I and Group II to exclude age changes. The changes seen in morphology of mandible were a measure of both osteoporosis and age.

Intragroup comparison: Comparison of Means in Group I came out to be highly significant. Multiple Comparisons between subgroups of Group I showed highly significant decrease in thickness of cortex at mental foramen between all three subgroups. P- value of <0.001 was observed at C.I of 95% as shown in Figure - 1.

Comparison of Means in Group II came out to be highly significant. Multiple Comparisons between subgroups of Group II showed highly significant decrease in thickness of cortex at mental foramen between all three subgroups. P- value of <0.001 was observed at C.I of 95% as shown in Figure - 1.

Intergroup comparison:

Intergroup comparison between Group I and Group II showed no change in thickness of cortex at mental foramen between pre A vs post A (0.905). It came out to be significant between pre B vs post B (0.002) and highly significant between pre C vs post C (<0.001) at C.I of 95% as shown in Figure - 1.

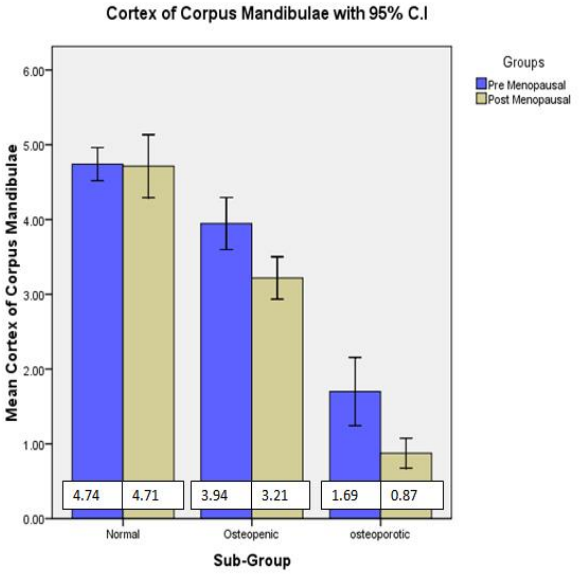
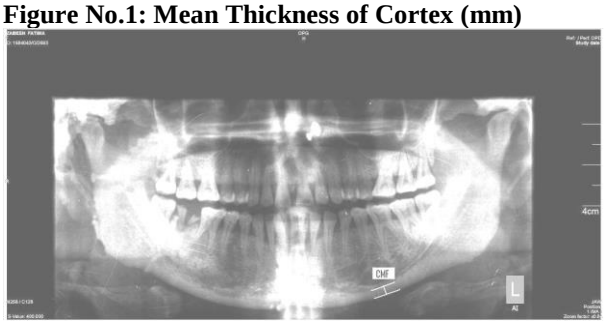
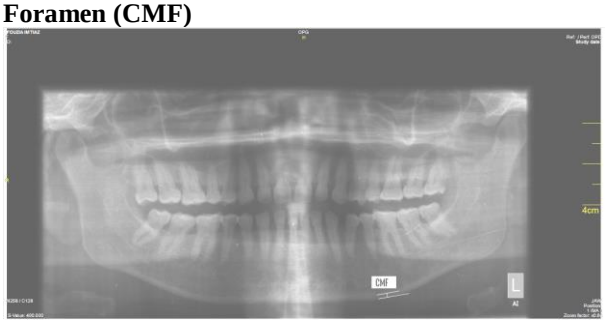


Figure No.1: Mean Thickness of Cortex (mm)



Cortex at Mental Foramen (CMF)

Radiograph No.1: OPG from Group II Post normal showing Normal Thickness of Cortex at Mental Foramen (CMF)



Cortex at Mental Foramen (CMF)

Radiograph No.2: OPG from Group I Pre osteoporotic showing Thinning of Cortex at Mental Foramen (CMF)

DISCUSSION

A number of studies are conducted on animals and humans which show changes in mandibular bone morphology and architecture in osteoporosis.[16] This study aims at observing the changes that take place in mandible secondary to osteoporosis.

This study is unique, since no study is still conducted on the changes of mandible where comparison is done in younger and older females excluding the age changes that occur along with decreasing bone mass. Now a day complications related to osteoporosis are a concern of every orthopedician. This study aims at helping the orthopedic community in diagnosing osteoporosis early as the study shows changes not only in osteoporosis but at stage of osteopenia as well. Previously it was thought that OPG X-ray is only a domain for dentists. This being a fact that OPG X-ray not only shows teeth but gives complete details of two more bones i.e. mandible and maxilla, our study tends to behave as a mile stone in changing the mind set. OPG X-ray is far more economical then DXA Scan. A cost effective technique can be employed in a developing country, like ours for screening purposes thereby referring patients further for bone densitometry.

The studies done previously employed complex methods such as radiological indices in studying mandibular changes.[17] The current study aims at looking closely at the mandibular changes in a simple manner in terms of changes in morphology easily accessed on a radiograph. Studies have shown changes in mandible in subjects with and without teeth.[18] Osteoporosis is known to be associated with increased teeth fall.[19]

The mandibular bone is primarily formed from contribution of both bone varieties. Total cortical bone mass at the level of the body accounts for some 80% while the rest of it is trabecular bone.[20] Any changes occurring in the outer cortical envelop can change the morphology markedly. The cortical width at mental foramen (CFM) along the inferior border was found to show highly significant reduction in thickness between all sub groups of Group I and Group II. As the changes are very obvious at stage of osteopenia this variable can be used for early detection of osteoporosis. The CMF was found to be the same in pre normal vs post normal groups which suggests that as a measure of age the CMF does not change. Not only this, cortex was seen to be significantly reduced in pre osteopenic vs post osteopenic groups and highly significant reduction in thickness was seen between pre osteoporotic vs post osteoporotic groups of Group I vs Group II. This makes it to be an indicator for low bone mass. The study seconds the findings of the study conducted by Akira Taguchi (2006), [21] Delvin H (2002)[22] and Gui-Zhen Jiang (2008).[14]

CONCLUSION

The findings conclude that the OPG X-ray can be used as a screening tool for osteoporosis. In addition to this the study also concludes that by looking at the cortex of the mandible early detection of osteoporosis can be done as these variables show changes at the stage of osteopenia. The cortex of the mandible was seen as part of mandible that shows osteoporotic changes exceeding age changes.

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