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OSTEOPOROSIS;
BODY OF MANDIBLE AND OSTEOPOROSIS

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ABSTRACT… Objectives: To establish a relation between changes in height of body of mandible on Orthopantomogram (OPG) X-ray with Dual Energy X- ray Absorptiometry (DXA) scan of femoral neck and spine to see whether or not the OPG X-ray can be employed as early detector and as a screening tool for osteoporosis. **Study Design:** Cross sectional study. **Setting:** Dow University of Health Sciences, Karachi Pakistan. **Period:** December 2011 to March 2013. **Methods:** A sample of 174 females 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 DXA Scan. Mandibular morphological changes seen on OPG X-ray in subgroups of Group I were compared with each other and with subgroups of Group II. The parameters that were considered on OPG X-ray were height of body of mandible at inner angle of jaw (HA) and at mental foramen (HF). One Way Analysis Of Variance (ANOVA) and T-test were applied to evaluate intragroup and intergroup significance respectively. **Results:** The reduction in height at angle (HA) and height at foramen (HF) showed that there was decrease in the height of body which was a measure of both osteoporosis and age. **Conclusion:** A simple and cost effective method of screening was established.

Key words: osteopenia and osteoporosis, Height at angle of mandible, Height at foramen

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INTRODUCTION

Osteoporosis is recognized in our society as the most common occurring problem second to heart disease. One out of three women suffer from it.[1] Osteoporosis is characterized by reduction in the amount of bone mass and consequent increase in fracture risk on minimal trauma.[2] A generalized reduction in bone mass that is less severe than that resulting from osteoporosis, caused by the resorption of bone at a rate that exceeds bone synthesis. DXA scan is the gold[2] standard for diagnosis of osteoporosis. It uses the T-scoring system. According to World Health Organization (WHO) T-score is the comparison of bone mineral density of a subject to that of young adult reference population. T-score -2.5 or below is defined as osteoporotic, T-score -1.0 or greater is normal and T-score between -1.0 and -2.5 osteopenia.[3,4,5,6]

The prevalence of osteopenia and osteoporosis was 43.4% and 12.9% respectively, as determined by a study conducted on 334 females above 20 years of age. According to the study, younger females are also at an stake of developing osteoporosis.[7] Different factors contribute to the causation of the disease. Estrogen is said to be protective against osteoporosis. Therefore, length of reproductive cycle is inversely proportional to number of case of low bone density.[8] Lack of nutrition, education, finances and primary health care are other important factors.[9,10] Smoking is a recognized risk factor for osteoporosis. It is assumed that if the present situation persists, the prevalence of osteoporotic fragility fractures will also increase.[11,12] One is likely to suffer from osteopenia and osteoporosis if she smokes for 1.5 and 5.4 years respectively.7 It has been reported that amongst the population of Pakistan, 72% people are disinclined to exercise.[13] Not only the present, but the childhood milk consumption is protective against osteoporosis.[14] A strong

association is seen between deficiency of both calcium and estrogen in the causation of osteoporosis in sham and ovariectomised rats.[15] Low levels of activated form of vitamin D are normally seen in subjects with low bone mass.[16] Even infants have been found to be deficient.[17] Many studies have shown that low levels of vitamin D are found in Pakistani women.[18-20]

Osteoporosis is one of the few diseases that share equal concerns in both medical and dental communities. The mandibular bone comprises of both spongy and compact bone varieties. In the body of mandible, total cortical bone mass is around 80% whereas the rest of it is trabecular bone. Morphology of body of mandible can change markedly owing to the changes occurring in the outer cortex. On an OPG X-ray the cortical width at mental foramen (CFM) along the inferior border has been found to show highly significant reduction in thickness between all sub groups.[21]

Our purpose of this study was to establish a relation between morphological changes in mandible on OPG with DXA scan of femoral neck and spine to see whether or not the OPG X-ray can be employed for early detection of osteoporosis. In addition it was aimed to see whether the OPG can be used as a screening tool for osteoporosis and locate areas of mandible where osteoporotic changes overwhelm changes related to age.

The study hypothesized that changes in mandibular morphology on OPG correlated with BMD of femoral neck and spine on DXA scan in normal and osteoporotic females.

METHODS

Ethical Review Statement

This was a study on human subjects so an application for the ethical consideration was forwarded to the ethical committee of Dow University of Health Science and approved by institutional review board of university (copy attached)

No information was given to any unconcerned individual without taking permission from the concerned patient and full confidentiality was ensured in general.

Study Design

It was a cross sectional study. Study tools used were the questionnaire, DXA Scan and OPG x-ray

Description of Selection of Subjects

Patients visiting Dow Radiology, their attendants, volunteers, patients from dental and orthopedic OPD, Ojha campus and patients from dental OPD Patel Hospital participated in the study.

Study Setting

Ojha campus DUHS and patel Hospital Karachi.

Study Duration

The study stretched over a period of 8 months and was completed in July 2012.

Sample Size Calculation

Total number of subjects considered was one hundred and seventy four. The sample size was calculated by OPEN EPI sample size calculator.

Sampling Method

Consecutive sampling technique was used.

Inclusion and Exclusion Criteria

Only females between 25 and 85 years were included in the study. Females with endocrine disorders, menorrhagia, oligomenorrhea and polymenorrhea were not included. Pregnant and lactating females, people addicted to beetle nut and pan chewing, females on oral contraceptive pills (OCP) and hormone replacement therapy (HRT) were excluded from the study.

Study Procedure

Informative posters were pasted at different campuses in DUHS inviting females to participate. Having signed a consent form and information sheet proforma regarding subject's history was filled, on the basis of which they were divided into premenopausal (Group I) and postmenopausal (Group II) groups. 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. Group pre A and pre B include 37 females each while pre C included 11 females. Group post A included 25, post B included 38 and post C included 26 females. OPG X-Ray was conducted at Patel hospital.

Height at angle (HA) and Height at foramen (HF) were worked out bilaterally on OPG X-rays at Zoom factor ×0.84 by using a software called K- Pacs- Lite. Two perpendiculars were drawn starting at the line along the inferior border up to the alveolar margin each at inner angle of jaw (HA)[22] and corresponding to the second premolar tooth at mental foramen (HF).[22] The mean of the two measurements taken from both right and left sides was put to statistical analysis. Intra observer and inter observer analysis gave a difference of 0.5mm each time.

STATISTICAL ANALYSIS

Intragroup Comparisons

Kruskul Wallis Test was applied in the groups where normality assumption was not fulfilled. One way analysis of variance (ANOVA) was applied to evaluate the significance between subgroups of Group I (premenopausal) and Group II (postmenopausal). For multiple comparisons in the subgroups of both groups Tukeys-B Test was applied.

Intergroup Comparison

Independent samples T- test was applied for inter group comparison.

RESULTS

The present study was designed to observe the radiological changes that take place in younger and older subjects after dividing them into normal, osteopenic and osteoporotic groups. Each variable was then studied in comparison with the subgroups of the same group and with the subgroups of the other group. The results were expressed as mean ± standard deviation and $p < 0.05$ was considered statistically significant at 5% margin of error and 95% confidence interval (C.I).

Intragroup comparisons were done between subgroups of Group I and subgroups of Group II to evaluate osteoporotic changes. Intergroup comparisons were done between Group I and Group II to exclude age changes.
The findings are as under:

Intragroup Comparison

Group I

An insignificant change in the height at angle of mandible and height at foramen was observed between Prenormal (Pre A) vs Preosteopenic (Pre B), Prenormal (Pre A) vs Preosteoporotic (Pre C) and Preosteopenic (Pre B) vs Preosteoporotic (Pre C) groups. When the means of three were compared the P- value did not come out to be < 0.05 as shown in Figure-1 and 2.

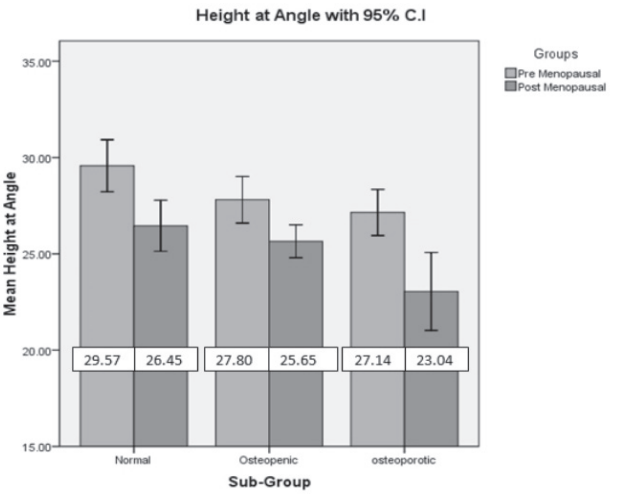

Figure-1. Mean height at angle (mm)

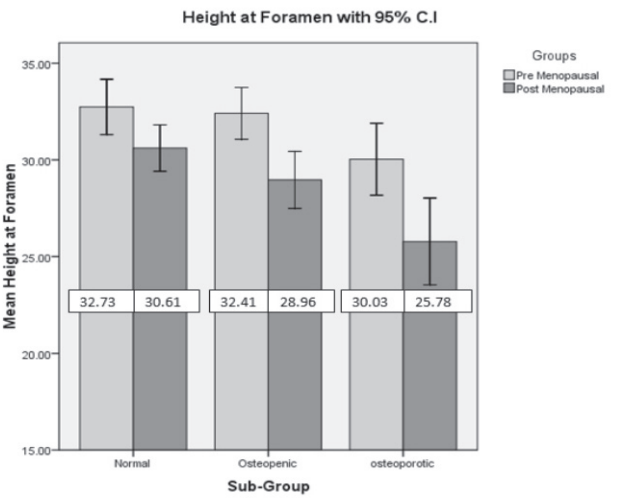

Figure-2. Mean height at foramen (mm)

		Pre Menopausal Mean ±S.D	Post Menopausal Mean ±S.D	P-Value
Height at Angle (mm)	Normal	29.57±4.04	26.45±3.20	0.007*
	Osteopenic	27.81±3.63	25.65±2.61	0.004*
	osteoporotic	27.15±1.79	23.05±5.01	0.001*
Height at Foramen (mm)	Normal	32.74±4.29	30.61±2.91	0.034*
	Osteopenic	32.41±4.02	28.97±4.47	0.001*
	osteoporotic	30.04±2.77	25.79±5.56	0.004*

Table-I. Comparison of means between Group I and Group II
Using two independent sample t-test p-value <0.05 was considered significant

Group II

An insignificant change in the height at angle of mandible was observed. Highly significant decrease in the height at foramen was observed between Postnormal (Post A) vs Postosteoporotic (Post C) and Postosteopenic (Post B) vs Postosteoporotic (Post C) groups. When the means of two were compared the P- value came out to be <0.001 and 0.013 respectively.

Intergroup Comparison

Height of body of mandible at angle and foramen was compared amongst subgroups of Group I and Group II.

A significant decrease in the height at angle and height at foramen was observed between Pre normal (Pre A) and Post normal (Post A), Pre osteopenic (Pre B) and Post osteopenic (Post B) and Pre osteoporotic (Pre C) and Post osteoporotic (Post C) as shown in Table-I.

DISCUSSION

Previously, quiet a number of researches on animals and humans have shown changes in the architecture of mandible secondary to osteoporosis.[23] Since no study is still conducted on the changes of body of mandible comparing younger and older female population, this study stands unique. As this study shows changes, not only in osteoporosis but at stage of osteopenia as well it aims at helping the orthopedic community in early detection of osteoporosis. OPG X-ray gives complete details of mandible and maxilla. It is far more economical then DXA Scan. A cost effective technique can be employed in a developing country for screening purposes. The current study, instead of employing complex methods, looks closely at the mandibular changes in a simple manner in terms of changes in morphology easily accessed on a radiograph.

The decrease in number of teeth causes the chewing forces on the mandible to reduce, thereby reducing the trabecular bone, thus decreasing the height of the body of mandible.[22,24] In addition to this, the decrease in the alveolar ridges contributes to the reduction in height of the body.[25]

Comparison between three subgroups of Group I showed no significant change in either HA or HF. This suggests that neither HA nor HF can be used as early detector of osteoporosis in the premenopausal group.

Height at foramen (HF) was found to be reduced in Group II. It was seen to be highly significant between post normal vs post osteoporotic and significant between post osteopenicvs post osteoporotic groups of Group II. This significant decrease in height at foramen (HF) can not only be used as early detector of osteoporosis but as a screening tool in the postmenopausal group.

Comparison between Group I vs Group II shows that significant changes occurred in pre normal vs post normal, pre osteopenicvs post osteopenic and pre osteoporotic vs post osteoporotic groups for both HA and HF. This suggests that HA and HF decrease not only as a measure of age as depicted by decrease in pre normal vs post normal, but as a result of changes in bone mass. Significant changes in subgroups pre osteopenic vs post osteopenic and pre osteoporotic vs post osteoporotic suggest that low bone density enhances the decrease in height of body of mandible at HA and HF in postmenopausal age.

These results are comparable to another study by M Bozic and N IhanHren in 2005[93] which observed same results.

CONCLUSION

In conclusion HA and HF can be used as a simple screening tool for osteoporosis for older population whereas HF alone can be used for younger population as well.

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Disclaimer

The abstract has not been presented or published in a conference.

Conflict of Interest

No conflict of interest included in study.

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Alone we I can go faster,
together we can go farther.

– Unknown –

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