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Comparison of Bone Mineral Density of Mandible with That of Spine & Femur in Osteoporotic & Non-Osteoporotic Post Menopausal Women Using Dxa Scan

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Abstract

Aims: The aim of this study was to assess the correlation between mandibular bone mineral density (m-BMD) at the mandibular body and the ramus with the bone mineral density (BMD) at the lumbar spine and the femur and to compare the m-BMD between the normal and osteoporotic patients.

Materials and Methods: Thirty post menopausal women were selected for the study and subjected to DXA (Dual Energy X-ray Absorptiometry) scanning. The patients were categorized as either Normal or Osteoporotic based on the BMD of the lumbar spine or the femur. The BMD values obtained from the body of the mandible and ramus of the mandible was compared between the patients with and without osteoporosis. Correlation between skeletal BMD with mandibular BMD was also evaluated.

Results: BMD of the body of the mandible had a highly significant positive correlation with the BMD of the lumbar spine and the femur. The BMD of the mandibular ramus had a positive correlation with the BMD measured

at the lumbar spine and the femur but this was not found to be highly significant. There was a significant difference in the mean value of the BMD of the body of the mandible between the normal and osteoporosis group but no significant difference in the BMD of the ramus among the two patient groups.

Conclusion: BMD measured in the lumbar spine and femur by DXA scan may serve as an indicator of the bone mineral density of the mandible.

Keywords: Bone mineral density, Mandibular Body, Mandibular Ramus, Osteoporosis, Dual Energy X-ray Absorptiometry

Introduction

Osteoporosis has been defined by the World Health Organization in the year 1991 as a 'progressive systemic skeletal disease characterized by low bone mass and microarchitectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture'. [1] Various studies have been conducted in India and the prevalence of osteoporosis among women has been found to be around 46 million.[2]

Bone mineral density (BMD) refers to the amount of mineral content of the bones present per square centimeter. It serves as an indicator of osteoporosis and is measured using DXA scan (Dual Energy X-Ray Absorptiometry). The lumbar spine and the femur are the most common sites in which BMD is measured to diagnose osteoporosis.[2-3]

It has been suggested that the osteoporotic changes occurring in the axial skeleton and the limbs also manifests in the jaws as osteoporosis is a systemic disease. [4]

Mandibular bone mineral density plays an important role in dental implant therapy as the success of the implant depends upon the quality and quantity of the bone. [5] Low BMD of the mandible has also been associated with pathological or iatrogenic fractures during procedures which may involve injudicious force such as dental extractions. [6] The purpose of this study was to assess the correlation between mandibular bone mineral density (m-BMD) at the body and ramus of the mandible with the BMD at lumbar spine and the femur and to compare the mandibular bone mineral density (m-BMD) at the body of the mandible and the ramus between normal and osteoporotic patients.

Materials and Methods

Thirty post menopausal women were selected for the study. The inclusion criteria included women with a natural menopause, who had a history of joint pains and were advised by their physicians to undergo DXA scan, with no relevant medical history and who weren't on any systemic drugs. Approval was obtained from the ethical board committee and patient consent was also obtained. The procedures carried out were in accordance with the Helsinki Declaration. BMD was measured at the lumbar spine and the femur using IDXA-GE Machine (Lunar iDXA 40782). The patients were divided into two groups of 15 as osteoporosis or normal (non osteoporotic) based on the T score obtained from the scanning results according to the WHO criteria. Normal (T-Score $\geq$-1.0), Osteopenia (T-score between -1.0 and -2.5), and Osteoporosis (T-score $\leq$-2.5). The DXA scan of the mandible was carried out in a rectilinear manner. BMD of the mandibular body was measured at the area just above the antegonial notch bilaterally and the average was taken. BMD of the ramus was also calculated bilaterally and the average was taken. **Fig. 1** To maintain standardization, the shape and size of the Region of Interest was equalized and all radiographic techniques were performed by the same operator.

The statistical analysis was done using Pearson correlation coefficient test and T test.

Results

The mean BMD values of the body of the mandible, ramus, lumbar spine and the femur are given in **Table 1**.

The BMD of the body of the mandible was found to have a strong positive correlation (r=0.7809) with the BMD at the lumbar spine and this was found to be statistically highly significant (P = 0.000).

Similarly, the BMD of the body of the mandible was found to have a strong positive correlation (r=0.8866) with the BMD at the femur and this was also statistically highly significant (P =0.000).

The BMD of the ramus of the mandible was found to have a positive correlation (r=0.4717) with the BMD at the lumbar spine which was statistically significant (P = 0.0085).

Likewise, BMD of the ramus of the mandible was found to have a positive correlation (r=0.3927) with the BMD at the femur but this was not significant (P = 0.0318).

The mean values of the BMD of the body of the mandible and the ramus of the normal BMD group and the osteoporosis group are depicted in **Graph 1** and **Graph 2** respectively.

There was a significant difference in the mean value of the BMD of the body of the mandible between the normal and osteoporosis group (P=0.003).

Although the mean BMD of the ramus of the mandible was higher in the normal group than the osteoporotic group, this was not found to be statistically significant at (P=0.060).

Discussion

A study by Horner et al on 40 edentulous female patients revealed that BMD of the mandibular body, and ramus measured by DXA correlated well with the BMD measured in the lumbar spine and the femur at P value <0.02. [7] This is in agreement with our present study where the BMD of the mandibular body had a strong positive correlation with the BMD measured in the lumbar spine and the femur. The BMD of the mandibular ramus also had a significant positive correlation with the BMD at the lumbar spine, and a positive correlation with the BMD at the femur which was however insignificant.

Cakur et al conducted a study on 80 women with osteoporosis. The mandibular bone mineral density was measured using DXA scans and compared with the measured skeletal BMD at the femur and the lumbar spine. No significant correlations was noted between the mandibular and skeletal BMD. This may be attributed to the different sample size and population used in the study. [8] In our study, only the BMD of the ramus failed to exhibit significant correlations with the BMD measured at the femur.

Buyukkaplan US et al conducted a study on 50 edentulous elderly patients which included 23 male and 27 female patients. BMD in the femur, spine and the body of the mandible was measured using DXA scan. Patients who were diagnosed with osteoporosis (low BMD in the femur) also had lower BMD of the mandibular body and this was found to be statistically significant at P value =0.001. [9] This is in agreement with our study where the osteoporotic patients had a significantly lower BMD of the mandibular body compared to the non osteoporotic patients.

There exists limited data regarding the correlation of mandibular BMD with BMD of skeletal sites such as the lumbar spine and the femur. Further studies with larger sample sizes are recommended.

Conclusion

Skeletal BMD measured at the lumbar spine and femur may provide preliminary information about the BMD of the mandible. Patients with osteoporosis have a lower bone mineral density of the mandible and hence caution is required during the dental management of these patients.

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Legends Figures and Table

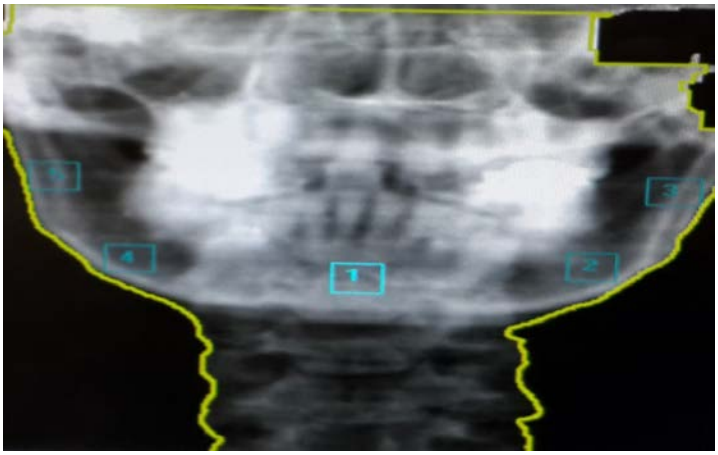
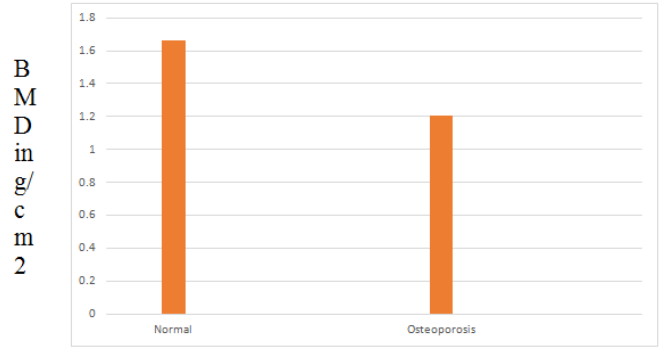


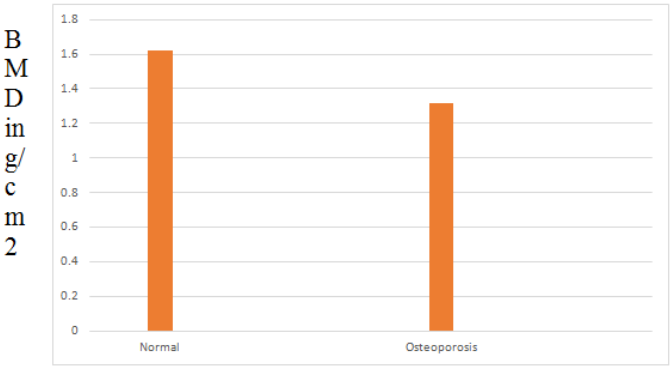
Fig. 1: Region of Interest Labelled 2 & 4 represent the mandibular body, just above the antegonial notch where BMD of mandibular body was measured. Regions 3 & 5 represent the area where the BMD of the mandibular ramus was measured.

Table 1: Mean values of BMD of the body of mandible, ramus, lumbar spine and the femur.

S. No	Parameter	No. of Patients	Mean BMD In G/Cm2
1.	BMD – Body of Mandible	30	1.4364
2.	BMD – Ramus	30	1.4704
3.	BMD – Lumbar Spine	30	1.0151
4.	BMD - Femur	30	0.9413



Graph 1: Mean Value of the BMD of the mandibular body among the patients classified as having Normal BMD and those with Osteoporosis.



Graph 2: Mean Value of BMD of the ramus among the patients classified as having Normal BMD and those with Osteoporosis.