



RESEARCH ARTICLE

A COMPARATIVE ANALYSIS OF BONE DENSITY OF MAXILLA AND MANDIBLE IN PRE AND POST-MENOPAUSAL WOMEN

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ABSTRACT

Dental implants have become a predictable treatment option for restoring missing teeth. The successful outcome of any implant procedure depends on a series of patient related and procedure dependent parameters. Bone density has been suggested as one of the main factors influencing implant therapy success. Purpose: To compare the bone densities of maxillary and mandibular bones in pre and post-menopausal women. Methods: Data was obtained from cone beam computed tomography of 2 groups: 20 premenopausal women and 20 post-menopausal women. Bone density was measured in maxillary and mandibular posterior region using the CS 3D software. Group averages were calculated and compared. Results: a significant difference was found in the bone densities of 2 groups ($p < 0.0001$). Bone density of maxilla and mandible in post-menopausal women was less compared to pre-menopausal women. Conclusion: The bone density of post-menopausal women is less as compared to pre-menopausal women. Radiographic analysis of the bone using CBCT is recommended to plan ahead for the consequences and complications, which can arise later.

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INTRODUCTION

Loss of posterior teeth may result in reduced masticatory efficiency, loss of vertical dimension of occlusion, poor aesthetics and loss of neuromuscular stability of the mandible, prosthetic rehabilitation should aim at restoring the vertical dimension and increasing the occlusal contact area in the premolar/molar region. Dental implants have become a predictable treatment option for restoring missing teeth (Muddugangadhar, 2015). The successful outcome of any implant procedure depends on a series of patient related and procedure dependent parameters. Bone density has been suggested as one of the main factors influencing implant therapy success (Misch, 1993). Areas of lesser bone density have exhibited higher failure rates and weaker primary stability values because implants depend on the surrounding bone for their support and retention (Molly, 2006; Holahan, 2011). Age related hormonal changes are known to decrease bone density in women. Studies show the influences of menopause on all the bones of the body. The evident loss of bone mass and bone mineral density after menopause have been reported for lumbar vertebral bodies and the femur.

Same is true for maxilla and mandible. Therefore, this study was undertaken with the purpose to compare the bone density of maxilla and mandible in pre and post-menopausal women

MATERIALS AND METHODS

The subjects were 40 female patients with partially edentulous maxillary and mandibular arches. 20 of these subjects were pre-menopausal and 20 were post-menopausal all in age group of 35 to 70 years

The post-menopausal selection (inclusion) criteria were

- Surgical or natural menopause for greater than 1 but less than 10 years,
- No glucocorticoid, hormone replacement, bisphosphonate therapy within 5 years
- No history of orthodontic treatment.
- The controls were likewise, randomly selected using the same criteria.

Exclusion criteria

- Patients with thyroid dysfunction, renal osteodystrophy and skeletal bone disorders

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- And patients on medications that affects bone metabolism such as vitamin D, estrogen preparations, bisphosphonates

Study Design

CBCT of all the patients were analyzed. The edentulous areas in maxillary and mandibular second premolar and first molar were identified and marked. The bone density in the same was measured in Hounsfield units in CS 3D Imaging software.

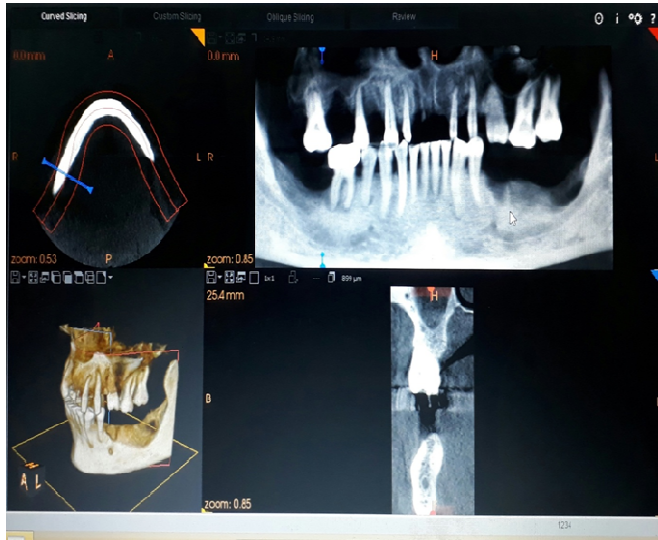


Fig 1. CBCT of a post menopausal woman

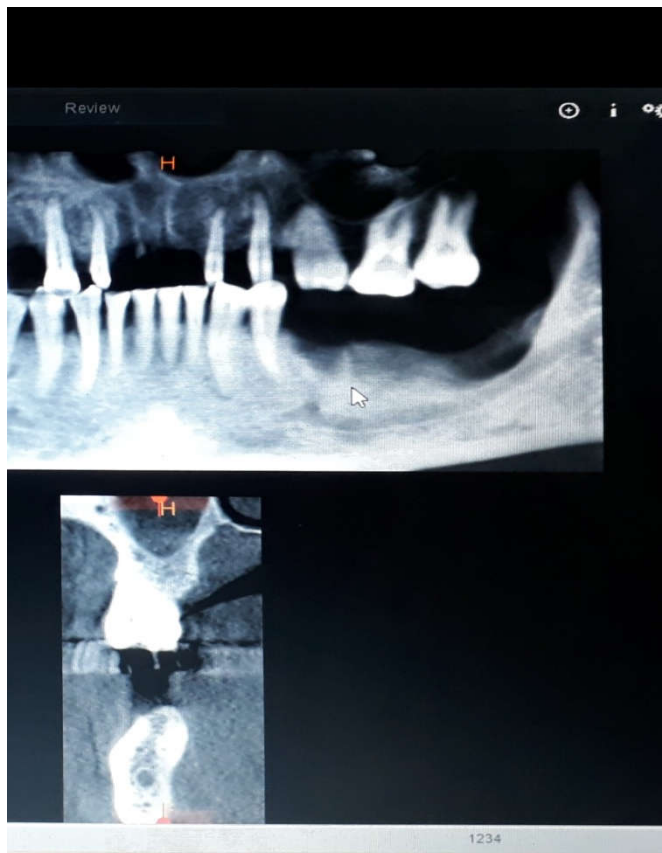


Fig 2. Pointer indicating the bone density in hounsfield units

Statistical Analysis

Bone density in the edentulous areas in both groups was calculated. Mean of all values was obtained and compared.

RESULTS

Table 1. bone densities in Hounsfield units

Group 1 N = 10		Group 2 N = 10	
maxillary	mandibular	maxillary	mandibular
589	744	210	454
701	912	225	460
652	846	230	436
597	720	334	446
643	835	398	532
723	911	331	487
675	870	227	412
820	989	328	517
987	1016	354	538
734	910	298	496
580	835	243	481
650	826	268	444
693	932	317	512
701	1026	350	525
725	1048	285	568
648	917	301	425
684	986	273	498
817	1234	316	535
676	850	385	601
712	998	401	689

P – value was calculated using the paired t test for maxillary and mandibular bone densities in group 1 and group 2
P value is less than 0.0001, which is considered as to be extremely significant

Comparison of mandibular bone densities in group 1 and group 2

Group	Group 1	Group 2
Mean	913.35	502.80
SD	99.91	66.06
SEM	22.34	14.77
N	20	20

Confidence interval:

The mean of group 1 minus group 2 equals 410.55
95% confidence interval of this difference: from 369.52 to 451.58

intermediate values used in calculations:

t = 20.9437
df = 19
standard error of difference = 19.603

Comparison of maxillary bone densities in group 1 and group 2

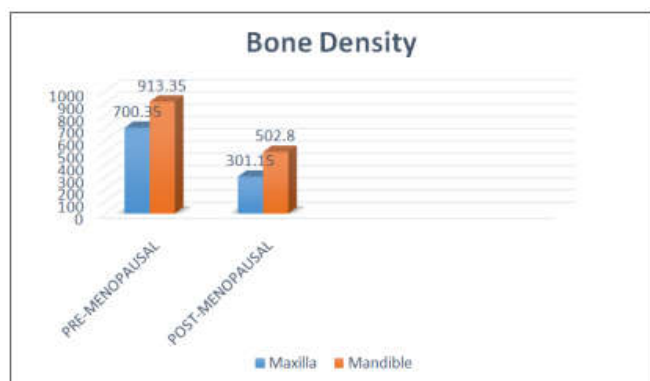
Group 1	Group 1	Group 2
mean	700.3	301.5
SD	92.48	54.94
SEM	20.68	12.29
N	20	20

Confidence interval:

The mean of group 1 minus group 2 equals 399.20
95% confidence interval of this difference: from 357.19 to 441.21

intermediate values used in calculations:

t = 19.88
df = 19
standard error of difference = 20.07



DISCUSSION

The findings point out that pre-menopausal and postmenopausal women have different bone densities. The rationale for these differences can be explained by hormonal regulation of bone turnover. Estrogen influences bone remodeling by reducing the over-all turnover rate. Without it, turnover increases with a net loss of bone; this explains our results in pre-menopausal and post-menopausal (Srhivastava, 2001 and Bagi, 1995). Similar results were obtained in a study conducted by Christine You Zhang, B.A. in which buccal bone thickness in esthetic zone was compared in pre and postmenopausal women (Christine). The findings of this study have several clinical implications. First, postmenopausal women warrant thorough site evaluation during implant planning. There is a correlation between bone density and primary implant stability as assessed with insertion torque and resonance frequency analysis measurements, and therefore bone density examination may be used as an additional feature in treatment-planning to estimate primary stability at predetermined implant sites (Salimov, 2014). Intra – operative surgical techniques such as bone condensing, under sizing the osteotomy improve the bone density and increase the primary stability (Marković, 2011) Bone density assessment using CBCT is an efficient method and significantly correlated with implant stability parameters and Lekholm and Zarb index (Lekholm, 1985). Pre-operative estimation of density values by CBCT is a reliable tool to objectively determine bone density. It is possible to predict initial implant stability and possibility of immediate or early loading using CBCT scans prior to implant placement (Gonzalez-Gracia). Bone density in this study is measured with the help of CBCT. It can also be determined more precisely by the various x-ray CT systems including helical CT and small radiation field CT and the wide variety of software available for image analyses and multiplanar reconstruction.

Conclusion

There is a significant difference between bone densities of maxilla and mandible in pre and post-menopausal women.

The bone density of post-menopausal women in this study was found to be less as compared to pre-menopausal women. Radiographic analysis of the bone using CBCT is recommended to plan ahead for the consequences and complications, which can arise later.

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