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Use of Panoramic Mandibular Index (PMI) and Mandibular Cortical Width (MCW) or Mental Index (MI) to evaluate the Bone Mineral Density (BMD) and to determine the Sexual Dimorphism – A Panoramic Radiographic Study

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Abstract

Throughout life, regressive changes occur in all of the body tissue including bone. Osteoporosis is one of such changes in human skeletal system, which initiates with the minimal bony changes called osteopenia. In most intense cases, this bony change begins with jawbones. In female population, post-menopausal individual has a faster rate of osteoporosis due to some hormonal changes whereas; in general, population it starts after the fourth decade of life osteoporosis starts. With the help of panoramic radiograph, we can assess bony changes of jaws and it is helpful to determine the osteoporotic changes. In panoramic radiograph, we can evaluated the qualitative and quantitative panoramic indices such as panoramic mandibular index (PMI) to determine the sexual dimorphism and assess the bone mineral density (BMD) as it is mostly influenced by age and gender.

A total no of 100 patients (50 male and 50 female) in the age group of 50-80 years were taken for the evaluation. Orthopantomogram (OPG) of each patient was taken and evaluated by Side axis 4 Viewer (Sinora) software. All the measurement was done by three professionals and the mean value was subjected to statistical analysis.

An independent t-test was used to determine the result. The mean of the age was 59.450 and the standard deviation was 7.022 for both groups. In males the mean

SL was 17.32 mm, mean IL was 14.15 mm and the mean MCW was 4.23mm... In females, the mean SL was 15.45mm, mean IL 12.94mm and the mean MCW was 3.89. In further calculation in males and females the mean sPMI and mean iPMI 0.24mm and 0.29 mm, 0.22mm and 0.26 respectively. In sPMI, iPMI and MCW parameters the the P value 0.084, 0.020 and 0.001 respectively and which were significant.

Keywords: MCW, iPMI, BMD

Introduction

Remodeling of bone is a natural process in which bone undergoes ceaseless transformation caused by the continuous formation and resorption. In this process, old bone is eliminated and newly formed bone takes place and overall bone mineral density (BMD) is maintained.[1] The amount of bone resorption increases than the formation and as a result BMD becomes lower in elderly people. In postmenopausal women, the resorption rate is quite higher and BMD becomes lower. As a result of resorption, osteopenia takes place and it changes to osteoporosis at longer period. BMD is a standard gauge for the measurement of bone mass in mg/cm^2 at a specific site.[1,2]

Osteoporosis is defined as “disease characterized by low bone mass and micro architectural deterioration of bone tissue, leading to enhanced bone fragility and a consequent increase in fracture risk.” Physiological factors that regulates the osteoporosis are mostly age and gender. Prognosis of osteoporosis is dependent on those factors.[2,3]

Osteoporosis can be appreciated in various parts of human body but as a dental professional, we consider mandible as a diagnostic area of interest. Quality and quantity of jawbones plays an important role on dental treatment as well as prognosis of the treatment. In orthopantomogram, we can appreciate the jaw bone quality and quantity by assessing the BMD, osteoporosis or osteopenia in various regions like inferior cortex of mandible, cortical width of the mandible and so on.[1,4]

In forensics, human identification is an important criterion to achieve. Dental identification is a positive method to identify the affected human. In disaster victim identification, in mass killing victim identification, the panoramic radiograph is an important tool to identify the victims. In panoramic radiographs, we appreciate various area of orofacial region to determine the victim. In order to identify the victim first determination of the gender is necessary. In orthopantomogram, the sexual dimorphism can be assessed in various way like determining the length of the mandible, width of the cortical bone and so on.[4]

Various radio morphometric indices like panoramic mandibular index (PMI), mental index (MI), gonion index (GI), antigonial index (AI), mandibular cortical index (MCI) are used to determine the osteoporosis, osteopenia or to assess the difference between them and sexual dimorphism. PMI is the ratio of the thickness of the mandibular cortex to the distance between the mental foramen and the inferior mandibular cortex.[5,6]

However, the dual energy x ray absorptiometry (DXA) scan is the gold standard for the measurement of the BMD. DXA scanner produces both the high and low energy x-ray and the scanner measures the amount of x-rays pass through the bone. It measures the difference between the absorption of the high and low energy x-rays pass through the bone. World health organization (W.H.O) has given certain criteria to measure the bone density.[7] It recommends assessing the T-score to determine the normal, osteoporosis, and osteoporosis in human. T-score is calculated by measuring the difference between patient’s measure BMD and mean BMD in young adults, which is relative to the young

adult population standard deviation. T ≥ -1.0, -2.5 < T < -1.0 and T ≤ -2.5 respectively represents the normal, osteopenia and osteoporosis.[7,8]

Materials and Methods

The institutional ethical committee for research approved this study. A total of 100 patients (50 females and 50 males) visited to the department of oral medicine and radiology, Teerthankar Mahaveer Dental College were randomly selected for the study. The age group were take 50-78 years of age as the mean age was 59.45 years. First, the importance and necessity of the study was explained to the patients and instructed to remove all the artificial objects like denture, ear rings, hair bands from head and neck region before the scans. Informed consent was obtained for the same from the patients.

Inclusion criteria were

1. Individual above 50 years of age.
2. Post menopause (after 12 months of amenorrhea with no obvious pathology).
3. Females with no history of oophorectomy or hysterectomy.

Exclusion criteria were

1. Smokers, alcoholics, any systemic disease which can affect the bone.
2. Pathology affected the jawbones like cysts, tumors etc.

Aim of the study was to determine the panoramic mandibular index and mandibular cortical width or mental index as a screening tool for the assessment of BMD and determine the sexual dimorphism. Objectives were to assess the risk of osteoporosis and to determine the gender of individuals.

All the patients were subjected to othopantomogram (Planmeca Proline XC, Finland) with proper radiation protection measures. 68-72 kVp was selected according to patient factors and 7 mA was selected with the total filtration of 2.5 mm Al. Then the OPGs were obtained by the Planmeca Romex is software with the patients details incorporated and were assessed by the Sidexis 4 software. Assessment was done by the three Oral Medicine and Radiology specialists in the same conditions to reproduce better result.

All the measurements were done in the Sidexis 4 software. Following measurements were calculated-

1. Superior Length (SL) - SL is the distance between the superior margin of the mental foramen and the inferior border of mandible. In figure 1. A-A' represents the SL.
2. Inferior Length (IL) – IL is the distance between inferior margin of the mental foramen and the inferior border of the mandibble. In figure 1. B-B' represents the IL.
3. Mandibular cortical width (MCW) or mental index (MI) - First described by Ledgerton et al.[3] A perpendicular line was traced which passes through the center of mental foramen to the lower border of mandible tangentially. In figure 2. C-C' represents the MCW.

After the measurements of these three distances, PMI was calculated. It was first described by Benson et al in 1991[1,3].

1. Superior PMI (sPMI) = MCW/SL or MI/SL
2. Inferior PMI (iPMI) = MCW/IL or MI/IL

All the measurements were calculated bilaterally in the OPGs as the bone density may vary due to the different occlusal forces in both the sides and the mean value of the right and left side of the individuals were subjected to statistical analysis using t-test. All the data obtained from the each patient by one of the observers were documented in a specific pro forma specially designed for the study (Table 1 & 2). To determine the accuracy among the observers the Pearson's correlation was performed. The correlation coefficient was significant.

Result

In males and females, the mean age was 56.82 and 62.08 years respectively. In males, the mean SL, IL and MCW were 17.32mm, 14.15mm and 4.23mm respectively. Henceforth, the mean sPMI and iPMI were calculated as 0.24 and 0.29 respectively on males. In females, the mean SL, IL and MCW were 15.45mm, 12.94mm and 3.98mm respectively. Henceforth, the mean sPMI and iPMI were 0.22 and 0.26 respectively in females. (Table 1 & 2)

Mean age of the 100 study subjects was 59.45 years. Standard deviation (SD) for age was 7.02287 (Table 3). The mean SL and IL were higher in males than females with a mean difference of 1.90 and 1.20 respectively and it was statistically significant (Table 4 & 5). The mean MCW or MI also higher in males than females with a mean difference of 0.80 that was statistically significant (Table 6). The mean sPMI and iPMI were slightly higher in males than females with a mean difference of 0.02 and 0.03, which was also statistically significant (Table 7 & 8).

Discussion

Bone growth is encouraged by sex hormones such as testosterone and estrogen in males and females respectively.[8] Bone mass reach to its maximum at the age of 40yrs in males and 30-35yrs in females.[9] Osteoclastic activity of bone is stimulated by specific cytokines and this activity is prevented by estrogen, thus preventing osteoporosis. As Estrogen level decreases, it will increase osteoclastic activity by parathyroid hormones. Vitamin D synthesis is also affected by decrease in estrogen level which ultimately leads to reduction in calcium absorption.[6,8]

Benson et al in 1991 first proposed the PMI as a radio morphometric method. They suggested that the distance between mental foramen and inferior border of mandible is remain relatively constant throughout the life.[9,10] It is partially based on the method suggested by the Wical and Swoope for the determination of the correlation of residual ridge resorption (RRR) with mandibular height below the inferior edge of the mental foramen. The PMI evaluation procedure is a simple method. Only difficulties in this study was to determine the borders of the mental foramina in some cases. Mean of the bilateral measurements was calculated in this study.[11,12,22]

In this study sPMI and iPMI in males were 0.24 and 0.29 and in females were 0.22 and 0.26 and the mean difference was 0.02 and 0.03 which were similar to the study conducted by Benson et al in American population (Mean PMI- 0.31-0.35 in males and 0.25-0.26 in females)[1,6,12,21]. Bertha et al observed the similar result (mean PMI 0.30-0.38 in males and 0.28-0.36 in females) in Indian population. Rao et al[3,20] and Khaitan et al[1] also get the similar result in their study in Indian population as (mean PMI in males and females - 0.26–0.28) and (mean sPMI and iPMI in males were 0.22-0.26 and 0.27-0.33 and in females were 0.23-0.27 and 0.29-0.35) respectively.

Like in our present study, most of the current studies shows a higher range of PMI (sPMI and iPMI) in males than in females. Therefore, this radio morphometric index (PMI) is reliable enough to rule out the higher risk category for osteoporosis. Post-menopausal women are in the higher risk category to show reduced BMD than men in similar age group.

According to Devlin and Horner, [13,14,19] a cortical width of 3mm was the most appropriate threshold for referral for bone densitometry. In our current study, we got the result of MCW in males and females as 4.23 and 3.98 respectively, which was similar to the result obtained by the study conducted by Khaitan et al[1] (3.96-4.71 in males and 3.86-4.54 in females). Hardanti et al observed

the similar result (3.928 in males and 3.155 in females) obtained by our current study. Klemetti et al[15,18] and White et al[1,14] suggested that mid 4mm range is the more apposite for MCW.

For the evaluation of sexual dimorphism, the sPMI and iPMI were assessed for both the groups 0.24 and 0.29 in males and 0.22 and 0.26 in females respectively. In our current study we found the mean sPMI and iPMI are slightly higher in males than in females which was statistically significant. Kalinowski[15,16,18] et al also found the similar result.

In our study the mean SL and IL were observed higher in males than in females (mean SL and IL in Males were 17.32 and 14.15 and mean SL and IL in females were 15.45 and 12.94) which was similar to result obtained by Khaitan et al[1,17].

All the parameters were used in this study like SL, IL, PMI, MCW or MI shows significant statistical result in terms of evaluating sexual dimorphism.

Limitations

This study does not represent any specific age/race group for assessment of the BMD and sexual dimorphism. As our sample size was small, the result may vary in larger population groups. To determine the sexual dimorphism, we only assessed the above 50 age groups but it may vary in younger ages.

Conclusion

After the assessment of all the result it can be concluded that, PMI and MCW or MI as radio morphometric indices can be considered as a reliable tool for determining the bone mineral density. But in terms of assessing the sexual dimorphism PMI and MCW may vary as very few research have been done, though in our current study we got statistically significant result of PMI and MCW to determine the sexual dimorphism.

Ethical clearance – Taken from university ethical committee for research.

References

1. Khaitan T, Shukla AK, Gupta P, Naik SR. Is panoramic mandibular index a reliable marker in the evaluation of bone mineral density and sexual dimorphism? J Forensic Dent Sci 2019; 11:133-6.

2. Govind Raju P., Mahesh Kumar T.S., Chandra P., Balaji P., Sow Bhagya M.B. (2017) Panoramic Radio morphometric Indices of Mandible: Biomarker for Osteoporosis. In: Patel V., Preedy V. (eds) Biomarkers in Bone Disease. Biomarkers in Disease: Methods, Discoveries and Applications. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-7693-7_13

3. Benson BW, Prihoda TJ, Glass BJ. Variations in adult cortical bone mass as measured by a panoramic mandibular index. Oral Surg Oral Med Oral Pathol. 1991 Mar;71(3):349-56. doi: 10.1016/0030-4220(91)90314-3. PMID: 2011361.

4. Kwon AY, Huh KH, Yi WJ, Lee SS, Choi SC, Heo MS. Is the panoramic mandibular index useful for bone quality evaluation? Imaging Sci Dent. 2017 Jun;47(2):87-92. doi: 10.5624/isd.2017.47.2.87. Epub 2017 Jun 22. PMID: 28680844; PMCID: PMC5489673.

5. Anna n. Law, Anne-marie bollen, Ssu-kuang chen, detecting osteoporosis using dental radiographs: a comparison of four methods, The Journal of the American Dental Association, Volume 127, Issue 12, 1996, Pages 1734-1742, ISSN 0002-8177, https://doi.org/10.14219/jada.archive.1996.0134.

6. Gaur B, Chaudhary A, Wanjari PV, Sunil M, Basavaraj P. Evaluation of panoramic Radiographs as a Screening Tool of Osteoporosis in Post-Menopausal Women: A Cross Sectional Study. J Clin Diagn Res. 2013;7(9):2051-2055.

7. Saran G, Misra N, Umapathy D, Channaiah SG, Singh P, Srivatava S. Evaluation of the relationship of

mandibular cortical index and panoramic mandibular index with bone mineral density using panoramic radiography in postmenopausal women: A short study. J Indian Acad Oral Med Radiol 2015; 27:539-43.

8. Khojastehpour L, Mogharrabi S, Dabbaghmanesh MH, Iraji Nasrabadi N. Comparison of the mandibular bone densitometry measurement between normal, osteopenic and osteoporotic postmenopausal women. J Dent (Tehran). 2013 May;10(3):203-9. PMID: 25512746; PMCID: PMC4264091.

9. Akshita D, Asha V. Reliability of panoramic radiographic indices in identifying osteoporosis among postmenopausal women. J Oral Maxillofac Radiol 2017; 5:35-9.

10. Guiglia R, Di Fede O, Lo Russo L, Sprini D, Rini GB, Campisi G. Osteoporosis, jawbones and periodontal disease. Med Oral Patol Oral Cir Bucal. 2013 Jan 1;18(1):e93-9. doi: 10.4317/medoral.18298. PMID: 23229255; PMCID: PMC3548653.

11. Bajoria AA, Ml A, Kamath G, Babshet M, Patil P, Sukhija P. Evaluation of Radio morphometric Indices in Panoramic Radiograph - A Screening Tool. Open Dent J. 2015Jul31;9: 30310.doi: 10.2174/1874210601509010303.PMID:26464600; PMCID: PMC4598386.

12. Qaseem A, Snow V, Shekelle P, Hopkins R Jr, Forciea MA, Owens DK; Clinical Efficacy Assessment Subcommittee of the American College of Physicians. Screening for osteoporosis in men: a clinical practice guideline from the American College of Physicians. Ann Intern Med. 2008 May 6;148(9):680-4. doi: 10.7326/0003-4819-148-9-200805060-00008. Erratum in: Ann Intern Med. 2008 Jun 3;148(11):888. PMID: 18458281.

13. Ledgerton D, Horner K, Devlin H, Worthington H. Radio morphometric indices of the mandible in a British female population. Dentomaxillofac Radiol. 1999 May;28(3):173-81. doi: 10.1038/sj/dmfr/4600435. PMID: 10740473.

14. Alonso MB, Cortes AR, Camargo AJ, Arita ES, Haiter-Neto F, Watanabe PC. Assessment of panoramic radio morphometric indices of the mandible in a brazilian population. ISRN Rheumatol. 2011; 2011:854287. doi: 10.5402/2011/854287. Epub 2011 Sep 14. PMID: 22389803; PMCID: PMC3263751.

15. Hastar, Esin et al. “Evaluation of mental index, mandibular cortical index and panoramic mandibular index on dental panoramic radiographs in the elderly.” European journal of dentistry vol. 5,1 (2011): 60-7.

16. Uysal S, Cağirankaya BL, Hatipoğlu MG. Do gender and torus mandibularis affect mandibular cortical index? A cross-sectional study. Head Face Med. 2007; 3:37. Published 2007 Oct 30. doi:10.1186/1746-160X-3-37

17. Hardanti S, Azhari, Oscandar F. Description of mandibular bone quality based on measurements of cortical thickness using Mental Index of male and female patients between 40-60 years old. Imaging Sci Dent. 2011;41(4):

18. Horner K, Devlin H. The relationships between two indices of mandibular bone quality and bone mineral density measured by dual energy X-ray absorptiometry. Dentomaxillofac Radiol. 1998 Jan;27(1):17-21. doi: 10.1038/sj.dmfr.4600307. PMID: 9482017.

19. Drozdzowska B, Pluskiewicz W, Tarnawska B. Panoramic-based mandibular indices in relation to mandibular bone mineral density and skeletal status assessed by dual energy X-ray absorptiometry and quantitative ultrasound. Dentomaxillofac Radiol. 2002 Nov;31(6):361-7. doi: 10.1038/sj.dmfr.4600729. PMID: 12424634.

20. Blake GM, Fogelman I. The role of DXA bone

density scans in the diagnosis and treatment of osteoporosis. Postgrad Med J. 2007 Aug;83(982):509-17. doi: 10.1136/pgmj.2007.057505. PMID: 17675543; PMCID: PMC2600106.

21. Hardanti S, Azhari, Oscandar F. Description of mandibular bone quality based on measurements of cortical thickness using Mental Index of male and female patients between 40-60 years old. Imaging Sci Dent. 2011;41(4):151-153.

Legend Figure

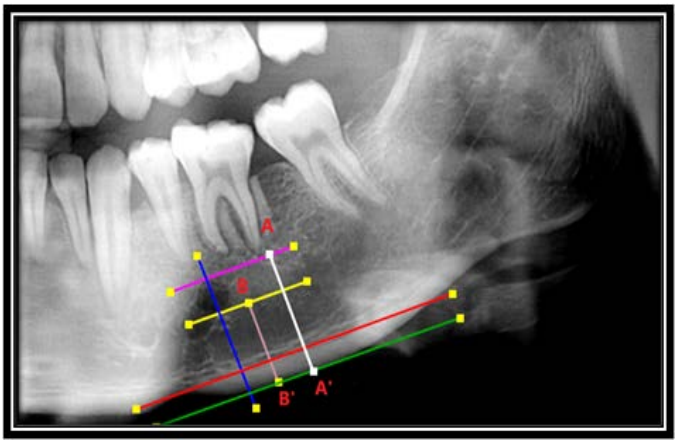

Figure 1: SL is the distance between the superior margin of the mental foramen and the inferior border of mandible. A-A' represents the SL. IL is the distance between inferior margin of the mental foramen and the inferior border of the mandible. B-B' represents the IL

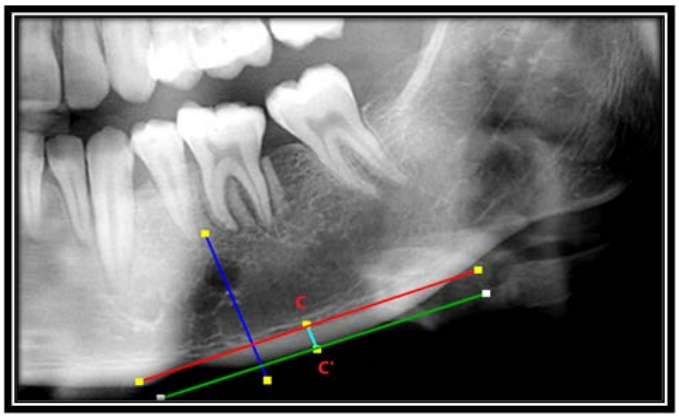

Figure 2: C-C' represents the MCW or MI

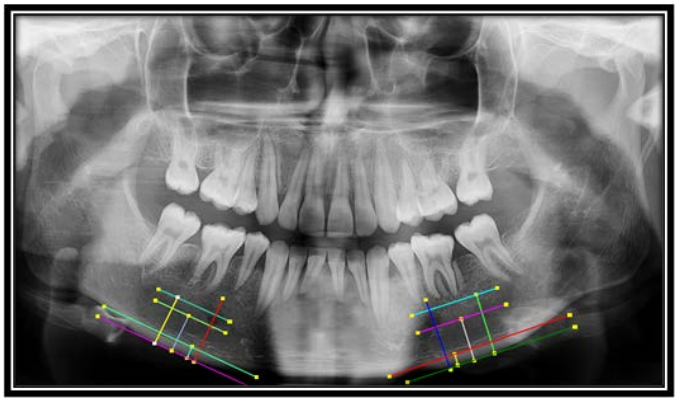

Figure 3: Bilateral measurements were done in this manner to measure the SL, IL and MCW or MI for all the subjects and the mean value was calculated.

Table 1: sPMI & iPMI in males

Sn.	Sex	Age (Years)	Mean SL Of Left & Right (mm)	Mean IL Of Left & Right (mm)	Mean MCW or MI Of Left & Right (mm)	sPMI = MCW or MI/SL Mean of Left & Right (mm)	iPMI = MCW or MI/IL Mean of Left & Right (mm)
1.	Male	50	20.13	16.90	5.11	0.25	0.30
2.	Male	50	19.25	16.82	4.91	0.25	0.29
3.	Male	50	19	16.71	2.44	0.12	0.14
4.	Male	51	18.47	15	3.95	0.21	0.26
5.	Male	51	17.67	15.11	4.78	0.27	0.31
6.	Male	52	18.56	16	5.09	0.27	0.31
7.	Male	52	19.12	16.21	3.99	0.20	0.24
8.	Male	53	20.49	16.25	3.67	0.17	0.22

9.	Male	53	21.38	16.01	3.56	0.16	0.22
10.	Male	53	16.09	14	4.91	0.30	0.35
11.	Male	53	17.22	14.11	5	0.29	0.35
12.	Male	54	17.34	13	4	0.23	0.30
13.	Male	54	16.05	13.89	3.82	0.23	0.27
14.	Male	54	17.65	13.41	2.99	0.16	0.22
15.	Male	55	15.76	12.55	3.11	0.19	0.24
16.	Male	55	16.77	13.80	2.43	0.14	0.17
17.	Male	55	18.59	13.31	3.92	0.21	0.29
18.	Male	55	19.43	14.01	4.33	0.22	0.30
19.	Male	55	15.66	12.11	3.98	0.25	0.32
20.	Male	55	14.76	12	4.90	0.33	0.40
21.	Male	55	14.90	11	2.13	0.14	0.19
22.	Male	55	16.08	12.97	3.22	0.20	0.24
23.	Male	55	16	12.98	3.45	0.21	0.26
24.	Male	55	17.46	14	4.01	0.22	0.28
25.	Male	56	16.55	13.01	3.44	0.20	0.26
26.	Male	56	16.33	13.97	4.33	0.26	0.30
27.	Male	57	15.91	12	5	0.31	0.41
28.	Male	57	14.61	12	4.99	0.34	0.41
29.	Male	57	17.87	14.95	4.97	0.27	0.33
30.	Male	57	16.04	14	3.98	0.24	0.28
31.	Male	57	16	13.39	4.15	0.25	0.30
32.	Male	58	17.91	14.91	4.54	0.25	0.30
33.	Male	58	18	15.21	5.11	0.28	0.33
34.	Male	58	16	13.05	4.91	0.30	0.37
35.	Male	59	15	12.46	3.42	0.22	0.27
36.	Male	59	15.77	12.22	4.22	0.26	0.34
37.	Male	59	17.34	14.56	3.19	0.18	0.21
38.	Male	59	17.09	14.78	5.21	0.30	0.35
39.	Male	59	16.97	14.99	4.19	0.24	0.27
40.	Male	60	16.74	14	5	0.29	0.35
41.	Male	60	16.91	13.92	4.97	0.29	0.35
42.	Male	60	16.84	14.02	4.32	0.25	0.30
43.	Male	60	17.40	15	3.99	0.22	0.26

44.	Male	61	21.02	17.92	5.11	0.24	0.28
45.	Male	61	19.81	16.22	5.36	0.27	0.33
46.	Male	65	19	15.22	5.98	0.31	0.39
47.	Male	66	18.87	14.67	4.99	0.26	0.34
48.	Male	67	16.44	13.02	4.89	0.29	0.37
49.	Male	67	15.97	13.25	3.99	0.24	0.30
50.	Male	68	16	13	4	0.25	0.30
		Mean Age = 56.82	Mean SL = 17.32	Mean IL = 14.15	Mean MCW or MI = 4.23	Mean sPMI = 0.24	Mean iPMI = 0.29

Table.2: sPMI & iPMI in females.

Sn.	Sex	Age (Years)	Mean SL Of Left & Right (mm)	Mean IL Of Left & Right (mm)	Mean MCW or MI Of Left & Right (mm)	sPMI = MCW or MI/SL Mean of Left & Right (mm)	iPMI = MCW or MI/IL Mean of Left & Right (mm)
1.	Female	50	16.06	14.22	3.33	0.20	0.23
2.	Female	50	14.04	11.98	4	0.28	0.33
3.	Female	50	16.44	13.23	4.11	0.25	0.31
4.	Female	51	14.22	11.98	2.65	0.18	0.22
5.	Female	51	13.99	11.99	3.54	0.25	0.29
6.	Female	52	14.77	12.11	4.44	0.30	0.36
7.	Female	52	15.23	12.98	4.89	0.32	0.37
8.	Female	53	15	12.56	3.98	0.26	0.31
9.	Female	54	16	13.98	4.56	0.28	0.32
10.	Female	54	14.87	12.11	4.32	0.29	0.35
11.	Female	55	15.33	12.98	4.65	0.30	0.35
12.	Female	56	16.22	14.11	3.98	0.24	0.28
13.	Female	56	17.32	15	4.09	0.23	0.27
14.	Female	56	14.11	12	2.43	0.17	0.20
15.	Female	56	15.09	12.22	3.54	0.23	0.28
16.	Female	56	15.34	12	3.51	0.22	0.29
17.	Female	56	16.99	14	5.44	0.32	0.38
18.	Female	57	17	14.53	5	0.29	0.34
19.	Female	57	16.43	13.98	4.45	0.27	0.31
20.	Female	58	13.39	12.98	3.23	0.24	0.24
21.	Female	58	14.34	12.33	3.29	0.22	0.26

22.	Female	58	15.09	13.21	4.93	0.32	0.37
23.	Female	59	15.99	13	4	0.25	0.30
24.	Female	60	16.43	14.76	3	0.18	0.20
25.	Female	60	16.65	14.34	2.33	0.13	0.16
26.	Female	61	15.77	12.32	1.54	0.09	0.12
27.	Female	62	15.33	12	3.04	0.19	0.25
28.	Female	63	15.97	14.1	4.21	0.26	0.29
29.	Female	64	14.99	12.44	4.44	0.29	0.35
30.	Female	65	15.34	12	3.54	0.23	0.29
31.	Female	66	16.42	14.44	3.56	0.21	0.24
32.	Female	66	18.43	16	3.15	0.17	0.19
33.	Female	67	14.55	12	2.50	0.17	0.20
34.	Female	67	15.97	13	4.20	0.26	0.32
35.	Female	68	15.56	12	4.01	0.25	0.33
36.	Female	68	15.44	12.22	3.98	0.25	0.32
37.	Female	68	15.01	12.97	4.33	0.28	0.33
38.	Female	69	15.34	13.33	2.11	0.13	0.15
39.	Female	70	16.78	15	1.34	0.07	0.08
40.	Female	70	14.44	11.98	1.90	0.13	0.15
41.	Female	71	14.54	12.49	2.21	0.15	0.17
42.	Female	71	13.53	11	2.44	0.18	0.22
43.	Female	71	15.98	13.30	2.58	0.16	0.19
44.	Female	72	14.54	12.65	2.65	0.18	0.20
45.	Female	72	14.37	11	2.98	0.20	0.27
46.	Female	73	16.65	14.08	4.79	0.28	0.34
47.	Female	74	15.29	13.09	3.95	0.25	0.30
48.	Female	75	15.99	12.44	3.70	0.23	0.29
49.	Female	78	14.56	11.98	1.56	0.10	0.13
50.	Female	78	13.98	11.01	1.32	0.09	0.11
		Mean Age = 62.08	Mean SL = 15.45	Mean IL = 12.94	Mean MCW or MI = 3.89	Mean sPMI = 0.22	Mean iPMI = 0.26

Table.3: Mean age of the study subjects.

	N	Minimum	Maximum	Mean	Std. Deviation
Age Years	100	50.00	78.00	59.4500	7.02287

Table.4: Sexual dimorphism in SL parameter.

	Sex	N	Mean	Std. Deviation	Std. Error Mean	T value	P value
SL	Male	50	17.3244	1.64755	.23300	6.478	0.001 (Sig)
	Female	50	15.4222	1.05358	.14900		

Graph 1

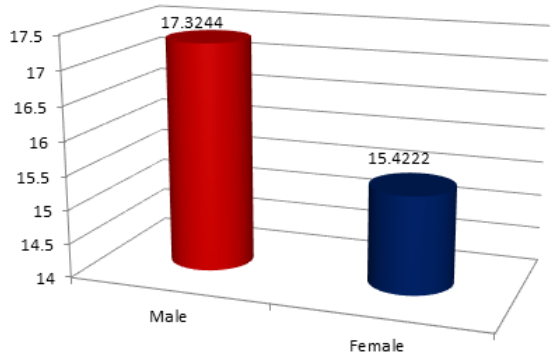

Table.5: Sexual dimorphism in IL plane.

	Sex	N	Mean	Std. Deviation	Std. Error Mean	T value	P value
IL	Male	50	14.1578	1.51185	.21381	4.531	0.001 (Sig)
	Female	50	12.9484	1.12989	.15979		

Graph 2

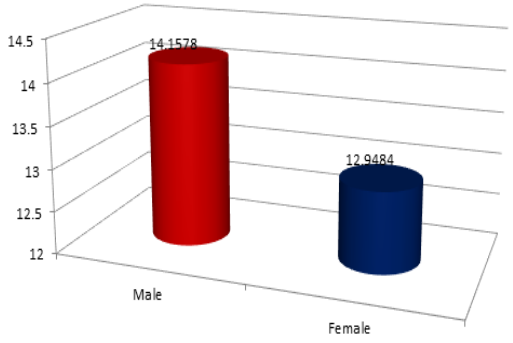

Table.6: Sexual dimorphism in MCW parameter.

	Sex	N	Mean	Std. Deviation	Std. Error Mean	T value	P value
MCW	Male	50	4.2390	.83651	.11830	4.060	0.001 (Sig)
	Female	50	3.4744	1.03632	.14656		

Graph 3

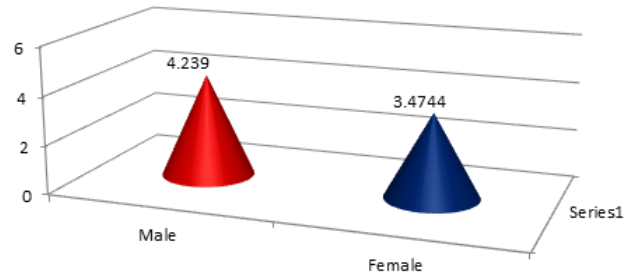

Table.7: Sexual dimorphism in sPMI parameter.

	Sex	N	Mean	Std. Deviation	Std. Error Mean	T value	P value
spmi	Male	50	.2406	.05016	.00709	1.445	0.084 (Sig)
	Female	50	.2204	.06468	.00915		

Graph.4

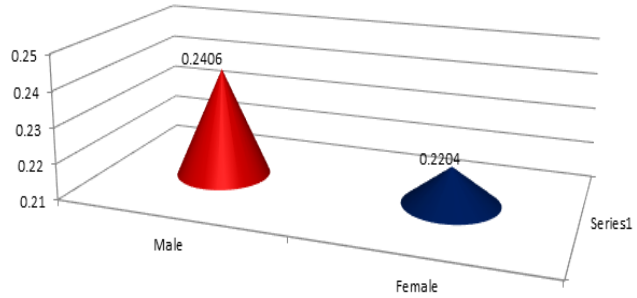

Table.8: Sexual dimorphism in iPMI parameter.

	Sex	N	Mean	Std. Deviation	Std. Error Mean	T value	P value
imp	Male	50	.2954	.05946	.00841	2.357	0.020 (Sig)
	Female	50	.2630	.07691	.01088		

Graph 5