Original Article

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Dentistry Section

Determination of Gender and Age by Analysis of Mental Foramen using CBCT in a Subset of Population in Kolkata, India: A Retrospective Study

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ABSTRACT

Introduction: Out of all the morphological landmarks in the human body, the Mental Foramen (MF) is thought to be one of the most reliable for determining age and gender. It has therefore been utilised in the current investigation to assess age and gender because of its durability.

Aim: To determine sexual dimorphism and to ascertain the age in a subset of Kolkata population, in West Bengal ,India, by analysing the MF using images obtained from Cone Beam Computed Tomography (CBCT).

Materials and Methods: The present retrospective study was conducted in Kolkata,West Bengal, India over a period of six months (January to June, 2024). Dentulous patients of age ranging from 18-60 years were included in the study. Among CBCT images of 70 subjects, 50 were included in the study as per the inclusion and exclusion criteria. The subject's Outpatient Department (OPD) registration number, gender and age were kept confidential, and a unique study number was allotted. The required measurements in the CBCT images, were done on these following parameters in both right and left side: 1) Superior Border or crest of Mandible to Superior Border of MF (SBM-SBMF); 2) Superior Border or crest of Mandible to Inferior Border of MF (SBM-IBMF); 3) Superior Border of MF to Inferior Border of Mandible (SBMF-IBM); 4) Inferior Border of MF to Inferior Border of Mandible (IBMF-IBM); 5) Superior Border of MF to Inferior Border of MF (SBMF-IBMF); 6) Superior Border of Mandible to Inferior Border of Mandible (SBM-IBM). A subset of Bengali Population was considered for the study. The information gathered was entered into a Microsoft Office Excel sheet, from which it was extracted to produce the desired outcomes using Stata version 13.1 (Stata Corp, USA). An independent t-test was used to compare the distance between the reference points and between the genders. Wilcoxen's correlation coefficient test was used to assess the strength of the correlation between the right and left-sides. Comparison between age groups was analysed by Mann-Whitney U-test and p-value of 0.05 was considered significant. Further logistic regression analysis was made, and the predictive percentage was calculated.

Results: In this subset of Kolkata population the mean measurement of SBM-SBMF on the right and left-side for the males were 13.40±3.33 and 12.12±3.25, respectively. Similarly for the females the measurements for the right and left-side were 12.58±2.47 and 12.49±2.66, respectively. The study's findings indicate that there is bilateral dimorphism in the (SBM-SBMF) and (SBM-IBMF) and (SBMF-IBMF) distances for both genders, making it a useful tool for distinguishing gender. Regarding age estimation, the research demonstrated substantial values for each of the four criteria. There were also bilateral differences noted. There is a substantial correlation between the estimated and original ages, according to the age regression model.

Conclusion: The MF being a sturdy landmark is a useful tool for determining gender and age. As a result, using particular MF measurements, one can determine the age of an individual. Additionally, preprosthetic surgery, implant placement, and orthognathic treatments use its location and distance from the alveolar crest as a guidance.

Keywords: Cone beam computed tomography, Dentulous arch, Mandible, Sexual dimorphism

INTRODUCTION

Determination of age and gender from severely dilapidated skeletal remains is an extremely important sub-discipline of forensic dentistry or forensic medicine at large. It is an important tread board in creating a biological silhouette from undivulged human remains, especially in utterly disfigured and perished conditions in cases of mass catastrophe or preposterous cases [1]. Several anatomical milestones like the bones of the skull vault, orbital bone, maxillary sinus, jaws and teeth and complete pelvic bone in the entire human skeleton can be used in the field of forensic science/medicine for identification of an individual or for ascertainment of gender, race and evaluation of age [2]. The human mandible being a robust osseous structure owing to the presence of dense cortical bone of the facial skeleton makes it a suitable tool for determining gender and estimating age [3]. MF is a small foramen which is routinely spheroidal in shape. It is a funnel-like crevice on the lateral aspect (buccal cortical plate) of the mandible, in close proximity to the root apices of the premolars, at the terminal of the mandibular canal/inferior alveolar nerve canal which disseminates mental nerves and vessels. The inception is directed outward; upward and posteriorly and therefore its visibility is compromised in Two-dimensional (2D) imaging modalities [4,5]. With the furtherance of technology along with maxillofacial radiology, CBCT is in a superior status to identify and provide close to perfect dimensions of anatomical landmarks by 3D viewing and reconstruction of maxillofacial structures. With the materialisation of Digital Imaging and Communications in Medicine (DICOM), CBCT also provides digital information that can be well-documented, conserved, evaluated and transferred [6,7]. The literature uncloaks that research on the estimation of age and determination of gender and that too in this subset of Bengali population using a 3D imaging modality is exiguous and justifies advanced exploration and therefore this study was undertaken as

no similar research has been conducted on this population and this study could contribute in the field of forensic science by providing essential demographic data in this region.

In this study, subjects between the ages of 18 and 60 were taken into consideration since, in contrast to the paediatric and teenage age groups, the disposition and dimension of the MF are rather consistent during this period. The aim of the study was to determine sexual dimorphism and to ascertain the age in a subset of Kolkata population, by analysing the MF using images obtained from CBCT. The primary and secondary objectives were to determine age and gender by analysis of MF using CBCT and to assess the accuracy of CBCT measurements in determination of age and gender respectively.

MATERIALS AND METHODS

The present retrospective study was carried out in the Department of Oral Medicine and Radiology at the Guru Nanak Institute of Dental Sciences and Research, Kolkata,West Bengal, India. The study includes CBCT scans that were captured from January, 2024-May, 2024. The data collection and analysis of the scans were done in April-May 2024 followed by statistical analysis in June 2024. The patient was assigned a unique research case number and their OPD registration number, gender, and date of birth were kept confidential. 50 of the 70 scans that were acquired were used in the current investigation as per the inclusion and exclusion criteria.

The study was done using CBCT scans from the Vatech GreenX18 CBCT machine (FOV 16×11) The scan parameters were as follows: voxel size 0.2-0.6 mm, tube current ≥10 mA, and kilovoltage ≥90 kvp. The reconstruction and measurement of the para-axial/cross-sectional views (slice thickness-0.1 mm) were performed using the Vatech EzDent-i software (Version 3.4.5) and viewed on Dell 21 inches IPS Panel Monitor.

Inclusion criteria:

- Subjects of 18-60 years of age.
- Dentulous patients.

Exclusion criteria:

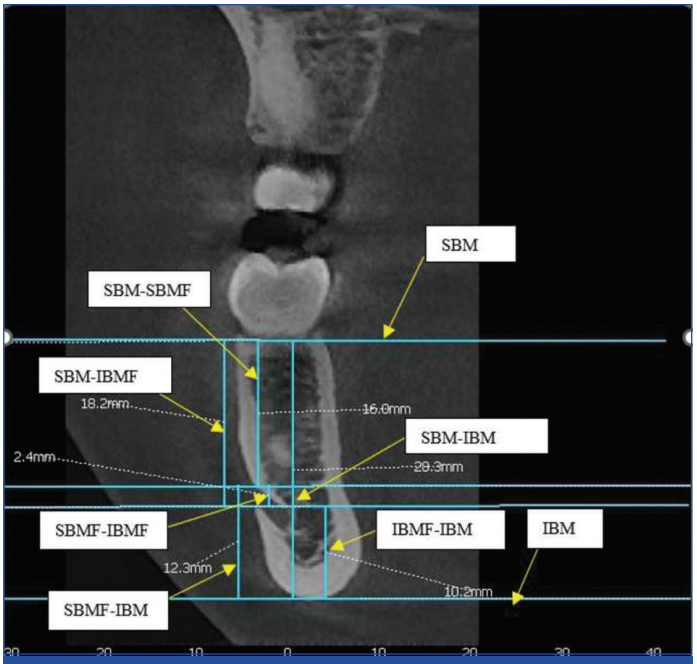
- Subjects of age less than 18.
- Subjects of age more than 60 years.
- Edentulous subjects.
- Presence of any radiological artefact.
- Presence of any pathology in the inter-foraminal region.
- Subjects with syndromes/congenital disorders.
- Presence of accessory MF.
- Patients with history of skeletal orthodontic treatment, orthognathic surgery, or any surgery in related region.

Study Procedure

The following parameters were used as the measurement of these parameters help to ascertain the exact position of the MF. Also, the following parameters provide thorough dimension of the MF which complements the analysis of MF in determination of age and gender. Studies with similar measurements have been performed in the past by Subhas TS et al., Prajapati A et al., Asrani VK et al., and Sourav Bose et al., [5,8-10].

The measurements (in mm) in the CBCT scans were taken in the cross-section/para-axial section and these following parameters were bilaterally measured in the mandible [Table/Fig-1].

1. Superior border of mandible to superior border of MF (SBM-SBMF).
2. Superior border of mandible to inferior border of mental foramen (SBM-IBMF).
3. Superior border of MF to inferior border of mandible (SBMF-IBM).



[Table/Fig-1]: Measurements taken on cross-section/para-axial section of CBCT image (slice thickness-0.1 mm).
SBM; Superior border of mandible; SBMF: Superior border of mental foramen; IBM; Inferior border of mandible; IBMF; Inferior border of mental foramen

4. Inferior border of MF to inferior border of mandible (IBMF-IBM),
5. Superior border of MF to inferior border of MF (SBMF-IBMF).
6. Superior border of mandible to inferior border of mandible (SBM-IBM).

STATISTICAL ANALYSIS

The complete data was entered and collected in an excel sheet (Microsoft Excel Version 2007). Data analyses were done using windows based statistical program Stata version 13.1 (Stata Corp, USA). Demographic measurements were summarised descriptively by age groups and gender. For data analysis summary statistics were provided for all the collected parameters, including mean and Standard Deviation (SD) 95% confidence interval, minimum, maximum for continuous variables.

Means with SD and standard error of the mean are used to express dimensional data. Numbers and percentages are used to express categorical data.

To compare the distances between the genders and between the reference points, an independent t-test was devised. To determine how strongly the right and left-sides were correlated, Wilcoxen's correlation coefficient test was employed. Confidence intervals were computed at 95% for every parameter. The predicted percentage was determined after additional logistic regression analysis.

RESULTS

Fifty CBCT images were divided into two groups, where group A consisted of subjects more than 30 years of age (N=22) and group B consisted of subjects less than 30 years of age (N=28). Among 50 CBCT images, 23 were of males and 27 were of females. [Table/Fig-2] shows comparison of SBM-SBMF, IBMF, IBM, SBMF-IBMF, and SBM-IBMF (right and left-side) between genders, where no statistical significance was found which suggests that any of the sides can be used for the assessment of gender. [Table/Fig-3] reveals the comparison of SBM-SBMF, IBMF, IBM, SBMF-IBMF, and SBM-IBMF (right and left-side) between the age groups i.e., group A and group B. The p-value in this case was found to be <0.001 revealing that all the criteria showed a highly significant statistical difference among right and left-side across the two age groups. Logistic regression Analysis and odd's ratio is shown in [Table/Fig-4].

Group statistics	Gender	N	Mean	Median	SD	Mean Diff	SE	95% C. I		t	p-value*
								Lower	Upper		
Age (years)	Male	23	31.70	28.00	11.53	-3.53	3.66	-10.89	3.84	-0.963	0.341
	Female	27	35.22	33.00	13.97						
SBM-SBMF (RS)	Male	23	13.40	12.60	3.33	0.82	0.82	-0.83	2.47	0.996	0.324
	Female	27	12.58	13.20	2.47						
SBM-SBMF (LS)	Male	23	12.12	11.50	3.25	-0.37	0.84	-2.05	1.31	-0.439	0.663
	Female	27	12.49	12.50	2.66						
SBM-IBMF (RS)	Male	23	16.25	16.00	3.61	1.17	0.89	-0.63	2.97	1.308	0.197
	Female	27	15.08	15.00	2.71						
SBM-IBMF (LS)	Male	23	15.66	14.90	3.50	-1.30	2.40	-6.12	3.53	-0.539	0.592
	Female	27	16.95	15.20	11.04						
SBMF-IBM (RS)	Male	23	16.50	16.30	2.31	2.12	0.57	0.96	3.27	3.691	0.001
	Female	27	14.39	13.90	1.74						
SBMF-IBM (LS)	Male	23	17.14	17.70	2.80	2.36	0.63	1.09	3.62	3.746	0.0001
	Female	27	14.78	14.80	1.56						
IBMF-IBM (RS)	Male	23	13.42	13.80	2.32	1.34	0.59	0.15	2.53	2.268	0.028
	Female	27	12.08	11.80	1.86						
IBMF-IBM (LS)	Male	23	14.23	14.80	2.79	2.28	0.60	1.07	3.49	3.778	0.0001
	Female	27	11.96	11.90	1.32						
SBMF-IBMF (RS)	Male	23	3.13	3.40	0.89	0.47	0.29	-0.12	1.05	1.604	0.115
	Female	27	2.67	2.50	1.14						
SBMF-IBMF (LS)	Male	23	3.52	3.30	1.13	0.66	0.33	0.01	1.32	2.035	0.047
	Female	27	2.86	2.80	1.16						
SBM-IBM (RS)	Male	23	29.27	29.40	3.10	2.38	0.91	0.54	4.21	2.605	0.012
	Female	27	26.89	27.50	3.31						
SBM-IBM (LS)	Male	23	29.51	28.90	3.47	2.88	0.97	0.92	4.84	2.960	0.005
	Female	27	26.63	26.50	3.40						

[Table/Fig-2]: Comparison of SBM-SBMF, IBMF, IBM, SBMF-IBMF, and SBM-IBMF (right and left-side) between males and females.
N: Number of patients; SD: Standard deviation; SE: Standard Error; CI: Confidence interval; RS; Right-side; LS: Left-side; p-value*: Independent t test
SBM; Superior border of mandible; SBMF: Superior border of mandible to superior border of mental foramen; IBM; Inferior border of mandible; IBMF: Inferior border of mandible

Group Statistics	Gender	N	Mean	Median	SD	Mean Diff	SE	95% C. I		t	p-value*
								Lower	Upper		
Age (years)	≤30 y	28	24.04	24.00	3.51	-21.74	1.99	-25.73	-17.74	-10.944	<0.0001
	>30 y	22	45.77	46.00	9.76						
SBM-SBMF (RS)	≤30 y	28	13.51	13.30	3.30	1.26	0.81	-0.37	2.90	1.555	0.127
	>30 y	22	12.25	12.40	2.14						
SBM-SBMF (LS)	≤30 y	28	12.74	12.55	3.12	0.94	0.83	-0.72	2.61	1.138	0.261
	>30 y	22	11.79	11.80	2.63						
SBM-IBMF (RS)	≤30 y	28	16.05	15.30	3.45	0.98	0.90	-0.84	2.79	1.083	0.284
	>30 y	22	15.07	15.20	2.76						
SBM-IBMF (LS)	≤30 y	28	17.87	15.50	10.68	3.44	2.37	-1.32	8.20	1.455	0.152
	>30 y	22	14.43	14.70	3.34						
SBMF-IBM (RS)	≤30 y	28	15.13	15.15	2.21	-0.54	0.65	-1.84	0.76	-0.832	0.410
	>30 y	22	15.66	15.30	2.35						
SBMF-IBM (LS)	≤30 y	28	15.45	15.65	2.48	-0.95	0.71	-2.37	0.46	-1.352	0.183
	>30 y	22	16.40	15.80	2.47						
IBMF-IBM (RS)	≤30 y	28	12.31	12.30	2.07	-0.87	0.61	-2.10	0.36	-1.426	0.160
	>30 y	22	13.19	13.80	2.24						
IBMF-IBM (LS)	≤30 y	28	12.86	12.45	2.77	-0.33	0.69	-1.72	1.05	-0.485	0.630
	>30 y	22	13.19	13.05	1.87						
SBMF-IBMF (RS)	≤30 y	28	2.77	2.65	0.89	-0.25	0.30	-0.85	0.35	-0.842	0.404
	>30 y	22	3.02	3.00	1.22						
SBMF-IBMF (LS)	≤30 y	28	3.25	3.20	1.24	0.20	0.34	-0.49	0.88	0.576	0.567
	>30 y	22	3.05	3.10	1.12						
SBM-IBM (RS)	<30 y	28	28.10	27.70	3.57	0.27	0.98	-1.70	2.23	0.273	0.786
	>30 y	22	27.84	27.95	3.24						
SBM-IBM (LS)	<30 y	28	28.22	28.20	3.51	0.60	1.06	-1.53	2.74	0.570	0.571
	>30 y	22	27.61	27.40	3.97						

[Table/Fig-3]: Comparison of SBM-SBMF, IBMF, IBM, SBMF-IBMF, and SBM-IBMF (right and left-side) between age groups (≤30 and >30 y).
N: Number of patients; SD: Standard deviation; SE: Standard Error; C.I.: Confidence interval; RS; Right-side; LS: Left-side; p-value*: Independent t test
SBM; Superior border of mandible; SBMF: Superior border of mandible to superior border of mental foramen; IBM; Inferior border of mandible; IBMF; Inferior border of mandible

Actual group	Predicted group		
Gender	Male	Female	% Correct
Male	18	5	78.3%
Female	6	21	77.8%
% of cases correctly classified			78.0%

[Table/Fig-4]: The prediction accuracy model for gender (n=50).
Odds Ratio (OR)-Predictive accuracy
Males versus Females: 1.029 (95% C.I. 0.268 to 3.942, p=0.967)
Females versus Males: 0.972 (95% C.I. 0.254 to 3.726, p=0.967)

p showed an overall statistically significant value and a prediction score of 78.3% for males and 77.8% for females. The calculation of odd's ratio reveals a predictive accuracy of males versus females: 1.029 and females versus males: 0.972.

The variables regression model [Table/Fig-5] showed an overall statistically significant p-value. Spearman's correlation of SBM-SBMF, IBMF, IBM, SBMF-IBMF, and SBM-IBMF in both right and left-side showed significance at the 0.05 level (2-tailed) and significance at the 0.01 level (2-tailed) [Table/Fig-6].

DISCUSSION

A range of techniques, including genetic, morphological, and morphometrical methodologies, have been devised by forensic professionals to analyse gender and age from human remains [11]. Because of sample degradation and contamination, forensic specialists may encounter difficulties when using molecular analysis of Deoxy Ribonucleic Acid (DNA) for age and gender determination [12]. Morphometric procedures are thought to be quick, easy,

Parameters	B	S.E.	Wald	p*	Exp(B)	p**	Included in equation
Right-side							
SBM-SBMF	-0.65	1.18	0.30	0.582	0.523	0.314	No
SBM-IBMF	-1.29	1.42	0.83	0.362	0.274	0.190	No
SBM-IBM	1.44	0.97	2.20	0.138	4.232	0.013	Yes
IBMF-IBM	0.11	0.94	0.01	0.904	1.120	0.028	Yes
SBMF-IBMF	1.56	1.61	0.94	0.333	4.752	0.111	No
Left-side							
SBM-SBMF	0.61	0.67	0.83	0.362	1.841	0.655	No
SBM-IBMF	0.09	0.27	0.11	0.743	1.094	0.583	No
SBM-IBM	-0.40	0.72	0.31	0.579	0.672	0.005	Yes
IBMF-IBM	-0.15	0.48	0.10	0.756	0.861	0.001	Yes
SBMF-IBMF	-0.52	0.55	0.90	0.342	0.594	0.046	Yes
Constant	13.93	5.16	7.28	0.007	1123773.775	-	

[Table/Fig-5]: Variables regression model (n=50).
p**: Overall statistically significant value

Pairs	r	p	95% CI for 'r'	
			Lower	Upper
SBM-SBMF (Right-side)-SBM-IBMF (Right-side)	0.900	<0.0001	0.827	0.943
SBM-SBMF (Right-side)-SBM-IBM (Right-side)	-0.175	0.225	-0.439	0.117
SBM-SBMF (Right-side)-IBMF-IBM (Right-side)	-0.100	0.490	-0.375	0.192
SBM-SBMF (Right-side)-SBMF-IBMF (Right-side)	0.067	0.645	-0.224	0.346
SBM-SBMF (Right-side)-SBM-IBM (Right-side)	0.711	<0.0001	0.533	0.829
SBM-SBMF (Right-side)-SBM-SBMF (Left-side)	0.659	<0.0001	0.459	0.795
SBM-SBMF (Right-side)-SBM-IBMF (Left-side)	0.757	<0.0001	0.601	0.857
SBM-SBMF (Right-side)-SBM-IBM (Left-side)	0.024	0.870	-0.264	0.308
SBM-SBMF (Right-side)-IBMF-IBM (Left-side)	-0.134	0.352	-0.405	0.158
SBM-SBMF (Right-side)-SBMF-IBMF (Left-side)	0.279	0.050	-0.008	0.523
SBM-SBMF (Right-side)-SBM-IBM (Left-side)	0.617	<0.0001	0.402	0.768
SBM-IBMF (Right-side)-SBM-IBM (Right-side)	0.005	0.975	-0.282	0.290
SBM-IBMF (Right-side)-IBMF-IBM (Right-side)	-0.129	0.371	-0.401	0.163
SBM-IBMF (Right-side)-SBMF-IBMF (Right-side)	0.430	0.002	0.164	0.638
SBM-IBMF (Right-side)-SBM-IBM (Right-side)	0.776	<0.0001	0.630	0.869
SBM-IBMF (Right-side)-SBM-SBMF (Left-side)	0.599	<0.0001	0.377	0.756
SBM-IBMF (Right-side)-SBM-IBMF (Left-side)	0.774	<0.0001	0.627	0.868
SBM-IBMF (Right-side)-SBM-IBM (Left-side)	0.135	0.348	-0.157	0.406
SBM-IBMF (Right-side)-IBMF-IBM (Left-side)	-0.056	0.701	-0.336	0.234
SBM-IBMF (Right-side)-SBMF-IBMF (Left-side)	0.403	0.004	0.132	0.618
SBM-IBMF (Right-side)-SBM-IBM (Left-side)	0.679	<0.0001	0.487	0.808
SBM-IBM (Right-side)-IBMF-IBM (Right-side)	0.752	<0.0001	0.593	0.854
SBM-IBM (Right-side)-SBMF-IBMF (Right-side)	0.407	0.003	0.137	0.621
SBM-IBM (Right-side)-SBM-IBM (Right-side)	0.476	<0.0001	0.220	0.671
SBM-IBM (Right-side)-SBM-SBMF (Left-side)	-0.092	0.525	-0.369	0.199
SBM-IBM (Right-side)-SBM-IBMF (Left-side)	-0.047	0.746	-0.329	0.242
SBM-IBM (Right-side)-SBM-IBM (Left-side)	0.744	<0.0001	0.581	0.849

SBM-IBM (Right-side)-IBMF-IBM (Left-side)	0.713	<0.0001	0.537	0.830
SBM-IBM (Right-side)-SBMF-IBMF (Left-side)	0.066	0.648	-0.224	0.346
SBM-IBM (Right-side)-SBM-IBM (Left-side)	0.443	0.001	0.180	0.647
IBMF-IBM (Right-side)-SBMF-IBMF (Right-side)	-0.107	0.460	-0.381	0.185
IBMF-IBM (Right-side)-SBM-IBM (Right-side)	0.461	0.001	0.201	0.660
IBMF-IBM (Right-side)-SBM-SBMF (Left-side)	-0.057	0.693	-0.338	0.233
IBMF-IBM (Right-side)-SBM-IBMF (Left-side)	-0.134	0.355	-0.404	0.159
IBMF-IBM (Right-side)-SBM-IBM (Left-side)	0.659	<0.0001	0.460	0.795
IBMF-IBM (Right-side)-IBMF-IBM (Left-side)	0.684	<0.0001	0.495	0.811
IBMF-IBM (Right-side)-SBMF-IBMF (Left-side)	-0.193	0.180	-0.454	0.099
IBMF-IBM (Right-side)-SBM-IBM (Left-side)	0.409	0.003	0.140	0.623
SBMF-IBMF (Right-side)-SBM-IBM (Right-side)	0.307	0.030	0.023	0.545
SBMF-IBMF (Right-side)-SBM-SBMF (Left-side)	0.067	0.643	-0.223	0.347
SBMF-IBMF (Right-side)-SBM-IBMF (Left-side)	0.277	0.051	-0.010	0.522
SBMF-IBMF (Right-side)-SBM-IBM (Left-side)	0.307	0.030	0.023	0.545
SBMF-IBMF (Right-side)-IBMF-IBM (Left-side)	0.161	0.264	-0.131	0.427
SBMF-IBMF (Right-side)-SBMF-IBMF (Left-side)	0.487	<0.0001	0.233	0.678
SBMF-IBMF (Right-side)-SBM-IBM (Left-side)	0.294	0.038	0.009	0.535
SBM-IBM (Right-side)-SBM-SBMF (Left-side)	0.534	<0.0001	0.293	0.711
SBM-IBM (Right-side)-SBM-IBMF (Left-side)	0.610	<0.0001	0.392	0.763
SBM-IBM (Right-side)-SBM-IBM (Left-side)	0.463	0.001	0.204	0.662
SBM-IBM (Right-side)-IBMF-IBM (Left-side)	0.326	0.021	0.044	0.560
SBM-IBM (Right-side)-SBMF-IBMF (Left-side)	0.208	0.147	-0.083	0.467
SBM-IBM (Right-side)-SBM-IBM (Left-side)	0.810	<0.0001	0.681	0.890
SBM-SBMF (Left-side)-SBM-IBMF (Left-side)	0.842	<0.0001	0.732	0.909
SBM-SBMF (Left-side)-SBM-IBM (Left-side)	-0.204	0.156	-0.463	0.088
SBM-SBMF (Left-side)-IBMF-IBM (Left-side)	-0.352	0.012	-0.579	-0.073
SBM-SBMF (Left-side)-SBMF-IBMF (Left-side)	-0.036	0.806	-0.319	0.253
SBM-SBMF (Left-side)-SBM-IBM (Left-side)	0.529	<0.0001	0.286	0.708
SBM-IBMF (Left-side)-SBM-IBM (Left-side)	-0.005	0.970	-0.291	0.281
SBM-IBMF (Left-side)-IBMF-IBM (Left-side)	-0.227	0.113	-0.482	0.063
SBM-IBMF (Left-side)-SBMF-IBMF (Left-side)	0.322	0.023	0.039	0.557
SBM-IBMF (Left-side)-SBM-IBM (Left-side)	0.640	<0.0001	0.433	0.783
SBM-IBM (Left-side)-IBMF-IBM (Left-side)	0.815	<0.0001	0.690	0.893
SBM-IBM (Left-side)-SBMF-IBMF (Left-side)	0.290	0.041	0.004	0.532
SBM-IBM (Left-side)-SBM-IBM (Left-side)	0.551	<0.0001	0.315	0.723
IBMF-IBM (Left-side)-SBMF-IBMF (Left-side)	0.019	0.895	-0.268	0.304
IBMF-IBM (Left-side)-SBM-IBM (Left-side)	0.368	0.009	0.091	0.592
SBMF-IBMF (Left-side)-SBM-IBM (Left-side)	0.236	0.098	-0.053	0.489

[Table/Fig-6]: Correlation coefficient (r) and significance (p) of SBM-SBMF, IBMF, IBM, SBMF-IBMF, and SBM-IBMF (right and left-side).

dependable, and economical, whereas morphological traits are subjective and more likely to be inaccurate [13]. Therefore, in this investigation, these criteria were taken into account.

Alveolar bone resorption has little effect on the distance between the MF and the inferior border, according to Wical and Swoope's findings. It stays largely unchanged throughout life [14]. The findings proposed by Wical and Swoope were also supported by Lindh C et al., [15]. Since panoramic radiographs were widely available, they were used extensively, despite some inconsistencies. Rather than the actual foramen, the radiographic MF on an Orthopantomogram (OPG) depicts a portion of the mandibular/IAN canal [5]. The other drawbacks of OPG include magnification, geometric distortion, artefacts, and vulnerability to placement mistakes because of the small focal trough, all of which could lead to imprecise replication of the MF's size and positions [16]. The most accurate and promising tool currently available for quantitatively detecting the location/placement of MF is high resolution CBCT.

In this study, subjects between the ages of 18 and 60 were taken into consideration since, in contrast to the paediatric and teenage age groups, the disposition and dimension of the MF are rather consistent during this period [16-18]. SBMF-IBM and IBMF-IBM measurements were used in this study to establish the vertical placement of the MF. Males had an average distance greater than females, indicating strong sexual dimorphism in these metrics. This was in line with the Subash TS et al., (2018) study on the population of south India [5]. Similar findings were noted in several studies on Polish (2019) [19], Egyptian (2020) [20] and Peruvian (2020) [21] populations. In contrast, a 2019 study by Shams N et al., on the population of Iran revealed no sexual dimorphism in terms of the MF's vertical positioning which could be attributed to the sample size and racial differences [22]. A 2018 study conducted in the Jordanian population found that female MF size tends to rise with age, but male MF size tends to decrease, indicating a potential function for sex hormones in MF size [23]. Using cumulative measurements of all parameters, the present study's gender prediction accuracy, based on logistic regression analysis, was 78%.

The present study reveals that the vertical disposition of the MF varies with age. It is in close approximation with the base of the mandible in younger age groups; it is intermediate between the superior border and the base of the mandible in middle age groups; and it is in close proximity to the superior border in older age groups. These results corroborated with that of Ahmed AA et al., who discovered that the

only statistically significant distance (p=0.01) is that which separates the inferior border of MF from the lower border of the mandible [24].

Limitation(s)

The limitations/drawbacks of this study include less sample size and unequal distribution of age and gender.

CONCLUSION(S)

The MF was assessed using 3D imaging since CBCT is currently considered the benchmark in maxillofacial imaging. This allowed for the precise measurement of the dimensions of MF without any imaging glitches. The present study inferred that the length of the mandibular crest up to the superior border of the MF, the height of the mandible from the alveolar crest to the inferior border, and the separation between the inferior border of the MF and the inferior border of the mandible all significantly affect age. Based on its clinical significance, this investigation demonstrated the potential utility of MF as a forensic criterion.

This particular subset of population displayed gender dimorphism, as indicated by the study's findings, with females showing a greater inferior placement of the MF to the inferior border of the mandible and a lesser diameter than males. It may also be concluded that SBMF-IBM, IBMF-IMB, and SBMF-IBMF are essentially unchanged throughout adult age groups. In future research identifying gender, the cumulative measurements of all these factors could be employed as a reliable morphometric evaluation method, as they produced a powerful prediction score of 78%.

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