Research Article

Orthopantomograph; a possible predictor of age and gender

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Abstract

As Orthopantomograph (OPG) is one of the most common radiograph routinely taken in dental hospital, which gives substantial information about all the teeth and surrounding structures, as there can be expected changes taking place in the mandibular bone, these changes may coincide with the age and gender, hence this study was conducted under three different age groups and in both the sex. 300 OPG s were considered for study, these OPGs were divided based on the age into three groups. A group-25 to 34;B group- 35 to 44;C group- 45 to 54. 50 digital OPGs (SIRONA, Germany) of male and 50 digital OPGs (SIRONA, Germany) of female of each group were considered and assessed for various parameters like Gonial angle, Anti Gonial angle, mandibular canal, mental foramen and mandibular foramen. These parameters were measured using the digital scale provided in the software. Out of the above five parameters only the measurements of mandibular canal and mandibular foramen were highly significant ($p < 0.05$) as the age advances. Mandibular canal and mandibular foramen can be possibly used for age prediction as it was significant in the study.

Keywords: Orthopantomograph (OPG), Mandibularcanal, Mandibular foramen.

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INTRODUCTION

Teeth and mandible are extensively used in many forensic odontological studies as they are strongest and non perishable sources of human skeleton and the inherent complexity seen in size, shape and proportions, which leads to individualisation[1] As the changes in the mandibular bone occur both in alveolar bone as well as basal bone through out the life[2], and these anatomical changes are of importance in clinical dentistry. As remodeling of the mandible takes place throughout the life cycle and these changes can be observed on dried mandible as well as on radiographic image[3], hence various parameters evaluated for age and sex prediction in the present study.

MATERIALS AND METHODS

Study was carried out in sri Siddharth dentalcollege, Tumkur, India. Patients from the OPD of the institution were included in the study as they were indicated for an OPG radiograph for diagnostic or treatment planning, hence unnecessary exposure of patient to radiation is avoided and patient consent and ethical clearance was obtained. Patient with any pathologies, bony abnormalities/bifid mandibular canal, and suffering from any systemic diseases affecting bone remodeling were excluded from the study, and OPGs with only good diagnostic quality were included. 300 OPG s were considered for study, patients above the age of 23 were considered and OPGs were made and these OPGs were divided based on the age into three groups.

A group: 25 to 34.
B group: 35 to 44
C group: 45 to 54

50 digital OPGs of male and 50 digital OPGs of females of each group were considered and assessed for various parameters like Gonial angle, Anti Gonial angle,

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mandibular canal, mental foramen and mandibular foramen. OPGs were made using ORTHOPHOS XG ^{PLUS}SIRONA (Germany) digital radiographic machine with SIDEXIS XG 2.41.01 software and DELL computer with Intel® Core™2 DuoCpu E7 500@2.93 GHZ and 2.5 GB RAM, 32BIT Windows 7 professional operating system. Parameters were assessed bilaterally by two oral radiologists using the digital scale provided in the software. Gonial angle was assessed by drawing a tangential along the lower border of the mandible and another tangential along the posterior border of ramus perpendicular to the lower border tangent, the angle formed by the intersection of these two tangential formed the gonial angle and these values were noted(fig-1). Antigonial angle was assessed by measuring the deepest point on the antigonial notch formed intersection of two parallel lines drawn towards antigonial notch (fig-1). Position of Mandibular foramen (fig- 1) is measured in three directions superiorinferiorly (M1), posterior anteriorly (M2), and anterioposteriorly (M3). Superior inferiorly line drawn from the deepest point of the mandibular notch to the mandibular foramen was marked (MI). Posterior anteriorly measurements were made by drawing a line from the posterior border of the ramus at the level of mandibular foramen to the actual mandibular foramen (M2). Similarly measurements were made anterio posteriorly by drawing a straight line from mandibular foramen to the anterior border of ramaus (M3). Mental foramen was assessed by drawing a perpendicular line from the mental foramen to the tangential line drawn along the lower border of the mandible (fig-1)[4]. Mandibular canal was measured by drawing a line perpendicular line drawn to the tangential line drawn at the lower border of the mandibular cortex from the lowest level of the canal on OPG (fig-1).

STATISTICAL ANALYSIS

Data was subjected to stastical analysis using student T-test, ANOVA, Tukeys Post Hoc analysis[5].

RESULTS

Gonial angle, anti gonial angle, mandibular foramen (M1, M2, M3) and mandibular canal were stastically highly significant in gender comparison (table-1). Mandibular foramen (M2) and gonial angle were stastically highly significant among along the groups (Table-2). Gender comparison for mandibular foramen at M2 and M3 was highly significant in all the groups (A, B, C) (table 3). On comparing genders with respect to antigonial angle measurements in group C were statistically highly significant. Gender comparison between the group B and C for gonial angle and mandibular foramen (M1) and mental foramen were stastically highly significant Gender comparison for mandibular canal in group A was highly significant. Gender comparison for mental foramen was highly significant. When right and Left side were compared, Gonial angle in group A, B and C were stastically highly significant and antigonial angle in group A and C were highly significant, but in group B it was stastically significant. Mental foramen in group A was statistically highly significant (table-3). In estimating the age the accuracy of the parameters were assessed for mandibular canal which was stastically highly significant. Mandibular foramen (M1) was stastically significant in group C for predicting the age (table-4).

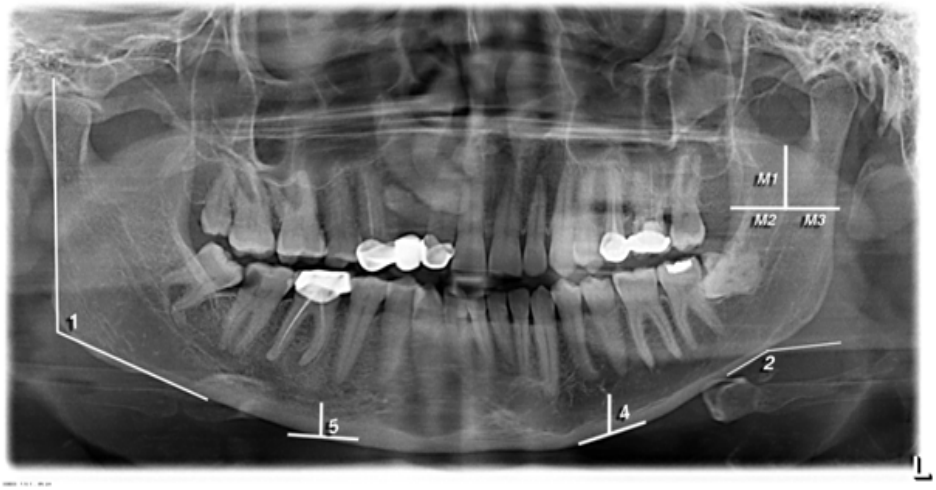

Figure 1: Parameters on the radiograph, 1.Gonial angle, 2. Antigonial angle, 3. Mandibular foramen measured in three directions (M1, M2, M3), 4. Mental foramen, 5. Mandibular canal

Table 1: Gender comparison of all the parameters and Mean of variables

Parameters	Gender	Means± SD	p-value
Mandibular foramen (M1) In millimeters	M	19.63±2.92	0.01
	F	18.26±2.97	
Mandibular foramen (M2) In millimeters	M	17.64±2.48	0.01
	F	15.35±13	
Mandibular foramen (M3) In millimeters	M	16.23±2.33	0.01
	F	15.01±2.33	
Gonial angle in degrees	M	118.05± 5.84	0.01
	F	126.09±5.99	
Antigonial angle in degrees	M	154.55±6.89	0.01
	F	159.66±6.76	
Mental foramen	M	13.33±2.26	0.01
	F	12.54±1.84	
Mandibular canal in millimeters	M	8.05±2.28	0.01
	F	6.89±1.75	

Table 2: Comparison of changes in parameters between groups

Sl no	Parameters	Groups	f-value	p-value
1(a)	Mandibular foramen(M1) In millimeters	A+B+C	0.464	0.64
1(b)	Mandibular foramen(M2) In millimeters	A+B+C	16.23	0.01
1(c)	Mandibular foramen(M3) In millimeters	A+B+C	0.88	0.92
2	Gonial angle in degrees	A+B+C	7.644	0.01
3	Antigonial angle in degrees	A+B+C	0.854	0.43
4	Mental foramen in millimetres	A+B+C	0.296	0.01
5	Mandibular canal in millimetres	A+B+C	4.198	0.16

Table 3: Comparison of right and left sides of the mandible among groups

Sl no	parameters	Age groups	Side		t-test	p-value
1a	Mandibular foramen(M1) In millimeters	Group A	R	L	3.014	0.01
		Group B	R	L	0.156	0.86
		Group C	R	L	0.062	0.95
2b	Mandibular foramen(M2) In millimeters	Group A	R	L	0.316	0-74
		Group B	R	L	0.418	0.68
		Group C	R	L	0.853	0.38
3c	Mandibular foramen(M3) In millimeters	Group A	R	L	1.196	0.22
		Group B	R	L	1.602	0.11
		Group C	R	L	0.401	0.66
2	Gonial angle In degrees	Group A	R	L	12.512	0.01
		Group B	R	L	7.491	0.01
		Group C	R	L	6.679	0.01
3	Anti gonial angle In degrees	Group A	R	L	4.622	0.01
		Group B	R	L	2.131	0.03
		Group C	R	L	2.839	0.01
4	Mental foramen In millimeters	Group A	R	L	2.833	0.01
		Group B	R	L	1.489	0.13
		Group C	R	L	0.421	0.66
5	Mandibular canal In millimeters	Group A	R	L	1.805	0.07
		Group B	R	L	0.201	0.83
		Group C	R	L	0.356	0.72

Table 4: Evaluation of parmeters in predicting age

Groups	parameters	Mandibular foramen(M1)	Mandibular foramen(M2)	Mandibular foramen(M3)	Gonial angle	Antigonial angle	Mental foramen	Mandibular canal
Group A	Pearson coefficient	0.022	-0.273	.028	0.01	-1.11	-0.06	0.74
	p-value	0.82	0.05	0.77	0.88	0.28	0.95	0.48
Group B	Pearson coefficient	-0.17	0.02	-0.102	0.04	-0.10	0.03	-0.05
	p-value	0.07	0.84	0.31	0.67	0.32	0.83	0.56
Group C	Pearson coefficient	0.19	0.14	0.16	-0.04	0.13	0.16	0.24
	p-value	0.04	0.17	0.12	0.65	0.19	0.74	0.01

DISCUSSION

The results of our study were similar to Armaghan A etal[2] and Enlow DH etal[6] studies, in all these studies the mean gonial angle were always obtuse in all the three age groups and the angle changed from more obtuse to less obtuse and again to more obtuse as the age advances[2] Similar to Kasat V etal[7] and Keiser NS etal[8]gonial angle of female patients were greater compared to male patients. In a study conducted by Kim JS etal[9] the mean gonial angle was 3-5 degrees greater in female patients compared to the males. On comparison of gonial angle between A, B and C groups in our study it was stastically highly significant in A verses B and B verses C groups but antigonial angles, were non significant. Accordingly the antigonial angle in females were greater, which can correlated with the study conducted by Benham NR etal[4] Samantha PP etal[10] , this can be attributed to the hormonal effects on bone remodeling. There was no stastical difference between the groups when analyzed for the position of mental foramen which was correlating studies carried out by Shendakar etal[11], again this was attributed to the remodeling pattern of mandible and effects of hormones on bone metabolism[11]. Mandibular canal had no significance in predicting the age in all the age groups except in group C, where it was statistically highly significant similar to the studies of Shendakar etal[11],where they attributed that the shape of the mandibular canal is independent of variation for age and sex. But in our study the mandibular canal value were significant between group B verses C and stastically highly significant in group C for predicting the age. Mandibular foramen assessment in three directions superior inferiorly (M1), posterior anteriorly (M2), and anterioposteriorly (M3) were assessed there was stastical significance in M1 and M3 directions, but in m2 direction measurements were stastically highly significant. This can be attributed to the bone remodeling in the anterior border and bone apposition in the posterior border of ramus[12]. In our study the mandibular foramen moves posteriorly similar to Xie QF etal[13]study. When compared between the groups B and C the mean value of M1 were high in males than females similar to the study conducted by Shendakar AT etal[11]. Mean of M2 and M3 were higher for males, this can be attributed to the stronger masticatory muscles in males[11]. Inter group comparison of mandibular foramen at M1, M2 and M3 directions was stastically highly significant when compared between the group A and B and C and A. Mandibular foramen at M2, M3 directions was non significant for assessment of age, but M1 was significant in assessment of age in group C.

CONCLUSION

From our study, it can be possibly concluded that mandibular canal and mandibular foramen can be considered for prediction of average age and it can further confirmed by evaluating the same in a larger sample size.

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