

Stature Estimating the Location of Maxillary Sinus and Mandibular Canal

Estimation of variations in the location of the maxillary sinus and the mandibular canal depending on the stature was done in cross sectional images. Alveolar bone height was determined in individuals of different height groups and a comparative study of location of the maxillary sinus and the mandibular canal in the jaws was done using linear tomographic program. Assessment of location of vital anatomic structures such as maxillary sinus and mandibular canal in the jaws are required while enterprising quality dental care during simple extractions, impactions, surgeries of the involved, and dental implants. The most common stature estimates are long bones based upon the principle that the various long bones correlate positively with stature.^[1] Relating the association of the stature with the location of maxillary sinus and mandibular canal helps in various dental procedures and in careful selection of the length of the implant. The results revealed the mean distance of the position of maxillary sinus and the mandibular canal in relation to the alveolar crest in the different height groups. A significant inference of this study reveals that height wise there was a very high statistical significance in the location of the mandibular canal.

The aim of the present study is to assess the location of the maxillary sinus and mandibular canal in different height groups attending the outpatient department. To compare the location of these anatomic structures among the different height groups. A total of 77 healthy dentulous patients ranging between 140 and 180 cm height, categorized into four different height groups were chosen from the outpatient dental clinic. The four groups were Group A (28) belonging to 140–150 cm, Group B (37) of 151–160 cm, Group C (18) of 161–170 cm, and Group D (7) of 171–180 cm. Patients below 15 and above 45 years or suffering from any form of infection in the jaws and systemic disease were excluded. Patients included had intact posterior teeth from premolars to molars and were devoid of any developmental defects.

After obtaining ethical committee clearance a linear tomographic radiograph was taken on patient in the standardized position with proper radiation protective

measures. The film was then developed in the automatic processor. The distance between the buccal alveolar crest and lingual alveolar crest up to the anatomical structures (the lowermost position of maxillary sinus and the superior position of mandibular canal) in maxilla and mandible was measured via Adobe Photoshop 7. Then the average of the distance between the buccal and lingual alveolar crests up to the anatomical structures was calculated and the derivatives were calibrated with the 1 cm scale measurements in the same radiograph. The magnification factor for the tomographic radiograph in promax planmeca, that is, 1.5 was also considered and calculated before arriving at the final values. Statistical test analysis of variance (ANOVA) was used to compare the four groups and Tukey honestly significant difference (HSD) was used for multiple comparisons between the groups.

The descriptive values of the mean distance from the lower most border of the maxillary sinus up to the alveolar crest of maxillary first and second premolars and molars in all the four groups did not reveal any statistical significance [Table 1]. Consequently multiple comparison of the mean distance of the lowest border of the maxillary sinus up to the alveolar crest of the maxillary first and second premolars and molars between individual groups also did not show any statistical significance [Table 2]. The mean distance of the superior border of the mandibular canal up to the alveolar crest of

Table 1: Mean distance between the maxillary anatomical structures at posterior teeth in different height groups

Descriptives						
Dependent variable	Height	N	Mean	S.D	F	P
Maxillary 1 st premolar	140-150	28	11.8325	2.47331	0.704	0.552
	151-160	37	11.9866	2.96910		
	161-170	18	11.6223	2.55781		
	171-180	7	10.4244	1.33485		
Maxillary 2 nd premolar	140-150	28	11.4593	1.97149	1.154	0.332
	151-160	37	11.1390	2.21630		
	161-170	18	10.7984	2.33375		
	171-180	7	9.8905	1.30509		
Maxillary 1 st molar	140-150	28	11.1601	2.13423	1.479	0.226
	151-160	37	10.9440	2.60781		
	161-170	18	10.5086	2.30085		
	171-180	7	9.1833	1.36831		
Maxillary 2 nd molar	140-150	28	10.8436	2.31305	2.040	0.114
	151-160	37	10.0007	2.45577		
	161-170	18	9.2882	1.89696		
	171-180	7	9.2738	2.31726		

the mandibular first and second premolars and molars in the individual height groups is shown in Table 3. Mean distance was receding as it moved posteriorly from the mandibular first premolar to second premolar, first molar, and second molar in all the groups. The mean distance was very highly significant in the premolars, whereas in the first molar it was highly significant and in the second molars it was significant.

Table 4 shows multiple comparison of the mean distance of the superior border of the mandibular canal up to the alveolar crest. The mean distance was very highly significant between the group A and group C in case of first mandibular premolar and molar. Highly significant mean distance difference was seen between the same group A and group C in case of second premolars and molars. There was significant mean distance difference between group B and group C in case of mandibular first and second premolar.

The mean distance from the lower border of the maxillary sinus and the superior border of the mandibular canal upto the alveolar crest in 77 patients with different statures was acquired in the Indian population using linear tomographic program of the cross sectional

imaging, which is easily accessible, economical, and relatively accurate. Assessment and correlation of the alveolar vertical height and location of vital anatomic structures with the stature benefits the dentist in clinical practice. Preoperative bone height was appraised from the top of the alveolar crest to the superior border of the mandibular canal on a standard panoramic radiograph and it was stated as a safe preoperative evaluation protocol for routine posterior mandibular implant placement.^[2]

Cross sectional imaging modality appears to be a very accurate tool in the assessment of the location of vital anatomic structures such as maxillary sinus and mandibular canal in the jaws, since it helps in evaluation of location of the vital anatomic structures, buccolingual width of jaws, bone thickness, and bone density. Conventional tomography is the most practical solution in the routine practice of dentistry as it is easily accessible, less complex, and very economical. American Academy of Oral and Maxillofacial Radiology (AAOMR) in its position paper edited by Tyndall and Brooks have recommended that some form of cross sectional imaging be used for implant cases and that conventional crosssectional tomography is the method of choice for gaining this information for most patients receiving implants.^[3]

Japanese study in panoramic radiographs showed that the sinus floor to the alveolar crest was 6.9 ± 4.75 mm on the right side and was 6.6 ± 4.78 mm on the left side in edentulous jaws.^[4] Our study which was carried out in

Table 2: Multiple comparison of individual height group for the mean distance difference in maxilla

Multiple comparisons (Tukey HSD)				
Dependent variable	(I)HT1	(J)HT1	Mean difference (I-J)	P
Maxillary 1 st premolar	140-150	151-160	-0.1541	0.996
		161-170	0.2102	0.994
		171-180	1.4081	0.593
	151-160	161-170	0.3643	0.964
		171-180	1.5621	0.485
		161-170	1.1979	0.741
Maxillary 2 nd premolar	140-150	151-160	0.3203	0.930
		161-170	0.6609	0.730
		171-180	1.5688	0.302
	151-160	161-170	0.3406	0.943
		171-180	1.2485	0.483
		161-170	0.9079	0.770
Maxillary 1 st molar	140-150	151-160	0.2162	0.983
		161-170	0.6515	0.792
		171-180	1.9768	0.195
	151-160	161-170	0.4353	0.916
		171-180	1.7606	0.267
		161-170	1.3253	0.582
Maxillary 2 nd molar	140-150	151-160	0.8430	0.464
		161-170	1.5554	0.121
		171-180	1.5698	0.376
	151-160	161-170	0.7125	0.704
		171-180	0.7269	0.869
		161-170	0.0144	1.000

Table 3: Mean distance between the mandibular anatomical structures at posterior teeth in different height groups

Descriptives						
Dependent variable	Height	N	Mean	S.D	F	P
Mandibular 1 st premolar	140-150	28	16.9366	2.79103	5.832	0.001 vhs
	151-160	37	18.1358	2.59376		
	161-170	18	20.1775	2.79472		
	171-180	7	19.7086	3.04229		
Mandibular 2 nd premolar	140-150	28	16.3067	2.60457	7.262	0.001 vhs
	151-160	37	17.2831	2.61343		
	161-170	18	19.2592	2.99777		
	171-180	7	20.3392	1.85431		
Mandibular 1 st molar	140-150	28	15.5485	2.55204	5.334	0.002 hs
	151-160	37	16.7616	2.91739		
	161-170	18	18.6821	2.58249		
	171-180	7	17.9105	2.15521		
Mandibular 2 nd molar	140-150	28	14.8804	2.47613	3.975	0.011 significant
	151-160	37	16.0149	3.03106		
	161-170	18	17.6330	2.66193		
	171-180	7	17.1044	2.61151		

Table 4: Multiple comparison of individual height group for the mean distance difference in mandible

Multiple comparisons (Tukey HSD)				
Dependent variable	(I)HT1	(J)HT1	Mean difference (I-J)	P
Mandibular 1 st premolar	140-150	151-160	-1.1993	0.303
		161-170	-3.2409	0.001 vhs
		171-180	-2.7720	0.084
	151-160	161-170	-2.0416	0.05 sig
		171-180	-1.5728	0.504
		161-170	0.4689	0.980
Mandibular 2 nd premolar	140-150	151-160	-0.9764	0.458
		161-170	-2.9525	0.002 hs
		171-180	-4.0325	0.003 hs
	151-160	161-170	-1.9761	0.05 sig
		171-180	-3.0561	0.031 sig
		161-170	-1.0800	0.796
Mandibular 1 st molar	140-150	151-160	-1.2131	0.281
		161-170	-3.1337	0.001 vhs
		171-180	-2.3621	0.169
	151-160	161-170	-1.9206	0.070
		171-180	-1.1490	0.729
		161-170	0.7716	0.918
Mandibular 2 nd molar	140-150	151-160	-1.1345	0.363
		161-170	-2.7526	0.008 hs
		171-180	-2.2240	0.234
	151-160	161-170	-1.6181	0.183
		171-180	-1.0895	0.775
		161-170	0.5286	0.973

different height groups showed that the location of the maxillary sinus from alveolar crest varied a lot and did not show any statistical significance. This may be due to a reduced sample size which may not be sufficient to possess a precise value and furthermore the degree of pneumatization differs from individual to individual and from side to side.^[5] Therefore the mean distance will differ among individuals and also from right to left maxillary sinus in the same individual.

The study directed in Japanese population revealed that the distance from the alveolar crest of the mandibular molar region to the superior wall of the mandibular canal was 9.1 ± 5.54 mm on the right side and was 9.9 ± 5.05 mm on the left side of the edentulous jaws.^[4] Similarly, the evaluation of mandibular canal from the alveolar crest in the Berne population showed that the average measured bone height from the mandibular canal to the alveolar crest in the panoramic radiograph was 13.9 ± 2.66 mm and the average bone height in linear tomography was 14.87 ± 3.3 mm.^[6]

Study in Turkish population showed that in mandible the vertical height showed high statistical significance

in the anterior part and statistical significance in the posteriors.^[7] This difference in the mandible was also noted in our study where the mean distance was very highly significant in the premolars, whereas in the first molar it was highly significant and in the second molars it was significant. This study revealed that the mean distance in the mandible was receding as it moved posteriorly. It is because the alveolar ridge resorption is normally more rapid in the posterior region than the anterior region of the mandible because of the lower position of the reversal line in the posterior region.^[7,8] The reversal line on the lingual side follows the mylohyoid ridge, which is the boundary between the resorptive and depository alveolar field of the basal bone.^[7,8]

The statistical significance may also be due to the steady development of the growth centers and the musculoskeletal system. Additionally, the size and shape of the mandible is also influenced by variable lifestyles, chewing habits, ethnicity, and stature. Literature review shows that most of the study is done on edentulous jaws for implant design. With reference to implant placement, it is significant to determine the amount of bone resorption taking place in an extraction wound. There will be a reduction of 0.8 mm in apicocoronal ridge height at 3 months and greater apicocoronal changes at multiple adjacent extraction sites which is more in molar areas than in the premolar sites and in the mandible relatively with maxilla.^[9] Apicocoronal crestal bone height reductions of 0.7-1.5 mm occurs after 4-6 months, and 2-4.5 mm over a 6-12 month postextraction period along with horizontal changes.^[10,11]

Thus subtracting resorption height from the mean distance in the mandible of different stature groups derived from our study population in south India, an appropriate implant length can be determined. This study was on 77 healthy dentulous patients of a local area and therefore represents only for this population. For a more accurate assessment, this study should be further conducted for a larger sample residing in various parts of the world.

Wide variations in jaw anatomy are encountered in different races and different populations and therefore the location of these vital structures vary among the individuals within considerably normal limits. Even within a given population, depending upon the patient's stature, age, sex, the location of these anatomically challenging vital structures may differ. Therefore prior to implant placement the location of these vital anatomic structures should normally be assessed by vigilant clinical examination and radiographic analysis.

Inferences drawn from this study were that the mean distance between the alveolar crest and the maxillary

sinus and the mandibular canal was decreasing as it was moving posterior. A very high statistical significance was observed in the mean distance of the mandibular first premolar region with a *P* value of 0.001 and a high significance was seen with respect to mandibular second premolar, first molar, and second molar. Thus our study suggests there is a positive correlation between the stature of an individual and the mean distance of the alveolar crest till superior most location of the mandibular canal. This study is confined to a small population in India and further work up of larger population in various study samples in other countries also is necessary to possess an accurate assessment value.

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10.4103/1947-2714.103322