

# Hyoid Bone Position in Orthodontic Patients

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## ABSTRACT

**Introduction:** Hyoid bone is attached to mandible and cranium by different ligaments and muscular attachments and plays important role in maintaining of functions of oral cavity such as posture of tongue. Hyoid bone is attached to mandible and cranium by different ligaments and muscular attachments and plays important role in maintaining of functions of oral cavity such as posture of tongue.

**Materials & Method:** Study was carried out in Nishtar Institute of Dentistry, Multan in May-June 2019. Lateral cephalogram of 113 patients were taken from orthodontic department and drawn by using 3H pencil and acetate matte sheets. Skeletal malocclusions were distributed into Class I, Class II and Class III on the bases of ANB angle. Hyoid bone position was determined using method devised by Bibby and Preston. IBM SPSS was used to assess the statistical data and mean, correlations and one sample t-test were applied.

**Result:** Data shows that in population of Multan, Pakistan, hyoid bone is posterior and downward in position and lies close to mandibular plane. Mean value of C3-H, Hyoid angle and H-RGn was 28.76mm ± 4.01mm, 15.26° ± 5.85° and 33.6mm ± 6.12mm.

**Conclusion:** It is concluded that hyoid bone is positioned more downward and backward direction in Skeletal Class I cases from given sample, moderately in Class III and less in Class II cases.

**Keywords:** C3-H plane, Hyoid angle, H-RGn plane and Lateral Cephalogram.

## INTRODUCTION

Hyoid bone is attached to mandible and cranium by different ligaments and muscular attachments and plays important role in maintaining of functions of oral cavity such as posture of tongue.<sup>1</sup> It is not directly related to the bones. Initially, it is present at level of lower border of mandible and it descends down with age to be present at level of C4 (cervical vertebrae) but position is also affected by different physiological functions such as head posture, swallowing and respiration.<sup>2</sup> Structural and positional importance of hyoid bone also affects different treatment modalities in orthodontics. It is situated in forward position in skeletal class II cases and in more backward position in skeletal class III cases when compared with normal skeletal class I cases. It was found in many studies that horizontal position of hyoid bone is stable measured through lateral cephalogram.<sup>3</sup> OSA (obstructive sleep apnea) and retrognathic mandible are important clinical condition affecting many patients of different sexes and age. Lateral cephalogram showed inferior and backward position of hyoid bone in OSA cases. Many patients facing this condition were treated with mandibular advancement via BSSO which brings hyoid bone close to mandibular plane as via discussed in different studies.<sup>4</sup> TMD and disc

displacement also influence hyoid bone position but this association needs to be investigated because some studies supports this association and others not.<sup>5</sup> Hyoid bone position and its relation with surrounding anatomical structures has interdepartmental importance while treating joint immobilization and calcification. It has been mentioned in many studies that racial and geographical variations exist in hyoid bone position.<sup>6</sup> Investigation to find position of hyoid bone helps to determine mode of treatment in orthodontic and different respiratory disorders.<sup>7</sup> Purpose of this study is to determine hyoid bone position in local population of Multan, Pakistan and racial variations among the patients of different skeletal malocclusion class I, class II and class III.

## MATERIALS AND METHOD

Total 113 patients were selected on the basis of ANB angle. This study was done in Nishtar Institute of Dentistry, Multan in May-June 2019. Approval for this was taken by institutional ethical review committee. Lateral cephalogram were taken from orthodontics department. 3H pencils were used to draw and construct planes on acetate matte sheets. Inclusion criteria of patients were:

**Sample Size: 113 patients**



Figure 1: Hyoid Bone Triangle

- No previous treatment
- No syndrome
- Age group 12-25 years
- No oral habits

Patients were distributed into three groups by drawing ANB angle:

- 44 Class I patients:  $0^\circ - 4^\circ$
- 47 Class II patients:  $>4^\circ$
- 22 Class III patients:  $<0^\circ$

Illuminator was used to draw the lateral cephalogram. All anatomical landmarks and tracings were cross checked by independent examiner. Parameters were taken from article by Bibby and preston<sup>8</sup> as show in Fig.1:

- C3-H :  $31.76 \text{ mm} \pm 2.9 \text{ mm}$
- C3-RGn:  $67.2 \text{ mm} \pm 6.6 \text{ mm}$
- H-Rgn:  $36.8 \text{ mm} \pm 5.8 \text{ mm}$
- Hyoid angle:  $25.63^\circ \pm 10.59^\circ$

C3-H plane was drawn by constructing line from third cervical vertebrae and to lower border of hyoid bone, H-RGn was drawn from lower border of hyoid bone to retro gnathion and hyoid angle was drawn from upper border of third cervical vertebrae to lower border of hyoid bone. Correlations and one sample t-test were applied. Data was analyzed by using IBM SPSS statistical data editor and was presented in tabulated form.

**RESULT**

IBM SPSS statistical data editor was used to analyze data after applying mean, correlations and one sample t- test. Mean of C3-H, Hyoid angle and H-RGn was  $28.76 \text{ mm} \pm 4.01 \text{ mm}$ ,  $15.26^\circ \pm 5.85^\circ$  and  $33.6 \text{ mm} \pm 6.12 \text{ mm}$ . Diversity of measurements among different skeletal classes were noted and given in tabulated form. Mean of C3-H, H-RGn and Angle in Class I, Class II and Class III are given in Table 1. A constant mean value of anteroposterior hyoid bone position C3–H was found in all skeletal patterns class I, class II and class III. A correlation was found between angular and anteroposterior position Table 2,3. Overall mean value of parameters selected for Pakistani population is less than European population when compared with their values e.g. C3-H  $31.76 \text{ mm} \pm 2.9 \text{ mm}$ , H-RGn  $36.83 \text{ mm} \pm 5.83 \text{ mm}$

Table 1. Mean values of Hyoid Triangle

skeletal class		C3-H length	hyoid angle	C3-RGn
Class I	Mean	28.94	15.57	34.11
	N	44	44	44
	S.D	4.42	6.62	5.71
Class II	Mean	28.61	14.97	32.2340
	N	47	47	47
	S.D	3.97	5.74	6.08
Class III	Mean	28.73	15.25	35.48
	N	22	22	22
	S.D	3.35	4.51	6.60
Total	Mean	28.76	15.26	33.6
	N	113	113	113
	S.D	4.01	5.85	6.12

Table 2: Correlations

		hyoid angle	C3-H length	C3-RGn
Hyoid angle	P.Correlation	1	0.099	0.037
	Sig. (2-tailed)		0.298	0.696
	N	113	113	113
C3-H length	P.Correlation	0.099	1	0.059
	Sig. (2-tailed)	0.298		0.532
	N	113	113	113
C3-RGn	P.Correlation	0.037	0.059	1
	Sig. (2-tailed)	0.696	0.532	
	N	113	113	113

Table 3: One-Sample Test

	Test Value = 0			
	t	Sig. (2-tailed)	95% Confidence Interval of the Difference	
			Lower	Upper
C3-H length	76.2	0.000	28.01	29.51
Hyoid angle	27.72	0.000	14.17	16.35
C3-RGn	66.24	0.000	32.46	34.46

and Hyoid plane angle  $25.63^\circ \pm 10.59^\circ$ . This shows that in Pakistani population position of hyoid bone is posterior and downward. Hyoid bone lies closer to mandible in local of Multan, Pakistan.

**DISCUSSION**

Precise assessment of hyoid bone by cephalometric means is difficult due to quality of radiograph. Main parameter of the hyoid triangle that affected by mandibular discrepancy is H-RGn length. Population variations exist due to geographical differences as it was noted in this study. Overall mean of

parameters in hyoid triangle is low in the present study as compared to European people e.g. Mean of C3-H, Hyoid angle and H-RGn was  $28.76\text{mm} \pm 4.01\text{mm}$ ,  $15.26^\circ \pm 5.85^\circ$  and  $34.04\text{mm} \pm 5.85\text{mm}$ . Present study was carried out in local population of Pakistan. Results showed that hyoid bone is posterior and downward in position due to extrusive component of fixed orthodontic appliance. This can be prevented by using TPA 6mm away from palate, chromosome arch or high pull headgear. Hyoid bone position varies in different skeletal malocclusions which in turn affects growth of mandible due to its connection with hyoid bone via muscular attachments. In high angle class III cases, position of hyoid bone is downward and backward. H-RGn is usually increased in class III cases.<sup>9</sup> In Lebanese population, position of hyoid bone is backward in class II patients which also supports finding of present study and more forwardly placed in class III patients. In class III cases hyoid bone is present in forward position as compared to class I cases.<sup>10</sup> Position of hyoid bone plays an important role in success of orthodontic treatment based on type of mechanics used. It tends to move in more inferior and posterior position after treatment of class II div I bimaxillary dentoalveolar protrusion cases  $34.69\text{mm} \pm 4.85\text{mm}$  which is slightly higher than Pakistani population.<sup>11</sup> In a study, Obstructive sleep apnea and hyoid bone has strong

association with positioning of hyoid bone. In class III cases C3-H length  $48.47\text{mm} \pm 4.36\text{mm}$  appears to be longer which depicts forward positioning of hyoid bone due to prognathic mandible. CBCT plays important role in this case to determine 3D volume of pharyngeal area. In class I cases C3-H show slightly higher value than present study  $38.04\text{mm} \pm 5.04\text{mm}$ . One of finding is that hyoid bone tends to descend down with age.<sup>12</sup> The hyoid bone is positioned more superior and posterior in females than males and its location differs among different skeletal classes. It is placed more posterior in skeletal class II patterns and more inferior and anterior in skeletal class I patterns.<sup>13</sup> Further studies should be performed to know effect of age, sex and skeletal pattern by enlarging sample size and increasing parameters to evaluate hyoid bone position.

## CONCLUSION

It is concluded that average value of parameters used to evaluate hyoid position in population of Multan, Pakistan is  $28.76\text{mm} \pm 4.01\text{mm}$  (C3-H),  $15.26^\circ \pm 5.85^\circ$  (Hyoid angle) and  $33.6\text{mm} \pm 6.12\text{mm}$  (H-RGn). Hyoid bone is positioned in downward and backward direction. Position of hyoid bone in different skeletal patterns.

**OJN**

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