GENDER BASED CEPHALOMETRIC EVALUATION OF POSITION OF HYOID BONE IN DIFFERENT SKELETAL MALOCCLUSION AMONG PATIENTS REPORTING AT SANDEMAN PROVINCIAL HOSPITAL (SPH) QUETTA

Mehreen Butt, Nasrullah Mengal, Jahangir Hammad, Munir Ahmed

Sandeman Provincial Hospital, Quetta Pakistan

ABSTRACT

Objective: To compare the position of hyoid bone in different skeletal malocclusions in both genders from records of patients of orthodontic department, Sandeman Provincial Hospital Quetta.
Study Design: cross sectional study.
Place and Duration of Study: Department of Orthodontics dental section Sandeman Provincial Hospital Quetta, from Mar 2017 to Aug 2017.
Methodology: This study was carried out with the help of patient radiographs from records of Orthodontics department Sandeman Provincial Hospital Quetta. Beginning of study followed Ethical committee approval. The Sample size was 60. For the data collection, Non probability consecutive sampling technique was used. Samples were collected from Baluchistan.
Results: Each gender had 30 cases; 10 in each three of the classes. There was a greater horizontal linear measures C3-H, C3-Rgn found in males across all three classes.
Conclusion: There was a greater C3-H and H-Rgn found in males in comparison to females in all the class groups. Additionally, C3-H was found to be of the greatest distance in males in class 1 and 3 groups.

Keywords: Hyoid bone, Hyoid triangle, Skeletal malocclusion**.**

INTRODUCTION

The hyoid bone is U-shaped bone which is located between the mandible and the thyroid cartilage in the neck. Ligaments and muscles are attached to the lesser and greater cornu to connect them to the mouth`s floor[1]. The anatomical boundary is found above the floor of the mouth and tongue, below the larynx and posteriorly the epiglottis and pharynx[2]. This bone has greater significance in physiological functions i.e. respiration, ingestion and speaking; Researchers have indicated that changes of mandibular position are relevant to the hyoid bone changes, and the position of hyoid bone adapts to head`s antero-posterior changes[3,4]. Also, adaptation of hyoid bone position after orthognathic operations has been revealed[5,6]. The hyoid bone is distantly connected to the mandible by suprahyoid muscles that play an important role in hyoid bone elevation during swallowing[7].

There is no articulation of Hyoid Bone (HB), however, there is an association with some vital functions[8,9] asphonation, deglutition, respiration[10] and maintaining the upright posture of the head. Plane will be used by hyoid triangle analysis, located between the cervical vertebrae and the mandibular symphysis, which prominently causes reduction in the effects of changes in cranial posture on assessments of the position of the hyoid bone. The study aimed to define the position of the hyoid bone in class I, II and III skeletal malocclusions in males and females and to establish the existence of any sexual dimorp-hism in the position of the hyoid bone.

Hyoid Bone: U shaped bone situated in the anterior midline of the neck between the chin and thyroid cartilage.

Different malocclusion as:

- Skeletal malocclusion are divided into 3 groups

Correspondence: Dr Mehreen Butt, Orthodontics Department, Sandeman Provincial Hospital Quetta Pakistan
Email: mehreen82@hotmail.com
Received: 09 Jun 2019; revised received: 10 Jul 2019; accepted: 17 Jul 2019

- Skeletal Class I: Skeletal class I, based on ANB 2-4°.
- Skeletal Class II: Skeletal class II, based on ANB greater than 4°.
- Skeletal Class III: Skeletal Class III, based on ANB less than 0°.

The study was carried out at the department of Orthodontics dental section Sandeman provincial hospital Quetta for the duration of six months. The sample size of 60 subjects was divided into 3 groups on the basis of sagital skeletal relationship. Each group was sub divided into 2 in accordance to gender. The sampling techniques, used for data collection was non probability consecutive. The samples were from the population of Baluchistan.

The inclusion criteria followed the given characteristics involving both male and female patients'age between 12-25 years; with non-syndromic adolescent and norm divergent facial pattern (FMA between 21°-28°).

The exclusion criteria was Gross dental abnormalities; Oral habits; any form of cerebral palsy; Previous orthodontic history of treatment and the history of any diseases affecting the pharyngeal structures.

Patient radiographs was used from records of Orthodontics department Sandeman Provincial Hospital Quetta to conduct the study. Before beginning study, Ethical committee approval was sought. Standardized lateral cephalogram (size 18x24 cm) fulfilling the inclusion criteria was obtained from departmental records. For all radiographs, the same cephalostat (Seredex, Cranex excel Ceph, made in finland, model SL-4/PT-11C/C) was used. Hyoidtriangle analysis was be conducted. The formation of triangle follows joining the following cephalometric points.

Retrognathion: (RGn, the most inferior, posterior point on the mandibular symphysis),

Hyoidale: (H, the most superior, anterior point on the body of the hyoid bone), and C3 (the most inferior, anterior point on the third cervical vertebra. Then in each malocclusion these measurements are compared.

Data Analysis

Data was entered and analyzed in the SPSS version 22. Reliability of the data was computed by using the cronbach alpha (alpha = 0.657). At the very first, frequency distribution of demographic characteristics i.e. gender, age and skeletal class was plotted by using the pie charts; moreover the age was further plotted by using the histogram; for further analysis, the frequency distribution of skeletal class, parameter with respect to gender, age and both in the separate tables so that the results can be elaborated and explained in clear and simplified manner.

RESULTS

Gender distribution of patients showed that there was 30 patients in the each of the gender as shown in the table-I.

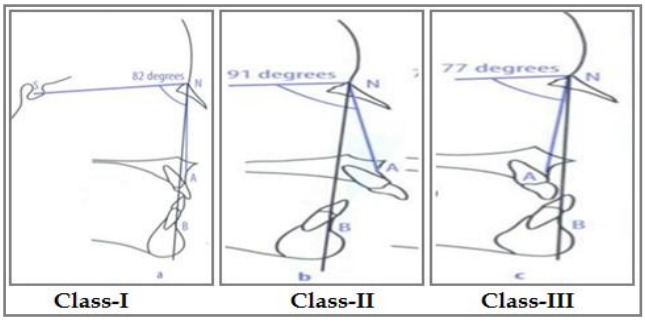

Figure: Showing Class-I: With ANB 2°-4°, Class–II: ANB >4°and Class-III: ANB <2°.

Table-I: Frequency distribution of Gender, age groups and skeletal class (n=60).

Gender	Frequency (n)	Percentage (%)
Male	30	50
Female	30	50
Age groups		
16-19	26	43.3
20-22	15	25
23-25	19	31.7
Skeletal Class		
Class 1	20	33.3
Class 2	20	33.3
Class 3	20	33.3

Age was divided into three groups which can be seen in the table-I. The number of patients in the age group of 16-19 years was 26 (43.33%); there were 15 (25%) patients in the age group of 19-22 years; the last age group (22-25 years), there were 19 (31.67%) patients.

Frequency distribution of skeletal class shows that there were 20 (33.33%) patients were in each of the skeletal class (table-I).

Frequency distribution of various skeletal classes and parameters with respect to the gender is taken out along with the mean distance (table-II). The maximum mean distance was measured to be 43.50 ± 2.819 in males from C3 to H in skeletal class I patients. Similarly in females maximum mean distance was measured to be 39.83 from H to RGn in the patients of Class 3 (table-II).

Frequency distribution of various skeletal classes and parameters with respect to the age is

Table-II: Gender, skeletal class parameter and mean distance.

Skeletal Class	Parameter	Gender	Frequency	Percentage	Mean ± Standard Deviation
Class 1	C3-H	Male	4	7	43.5 ± 2.819
		Female	5	8	36 ± 1.318
	H-Rgn	Male	6	10	39.83 ± 2.01
		Female	5	8	39.8 ± 1.16
Class 2	C3-H	Male	3	5	39.67 ± 3.18
		Female	5	8	35 ± 2.154
	H-Rgn	Male	7	12	38.29 ± 1.147
		Female	5	8	35.8 ± 2.98
Class 3	C3-H	Male	4	7	42.5 ± 1.87
		Female	4	7	36.5 ± 2.89
	H-Rgn	Male	6	10	39.33 ± 2.87
		Female	6	10	39.83 ± 3.65

Table-III: Age, skeletal class parameter and mean distance.

Skeletal Class	Parameter	Age	Frequency	Percentage	Mean ± Standard Deviation
Class 1	C3-H	16-19	4	7	37.5 ± 1.65
		19-22	2	3	45.5 ± 2.75
		22-25	3	5	37.67 ± 3.65
	H-Rgn	16-19	5	8	37.8 ± 2.87
		19-22	3	5	34.33 ± 3.65
		22-25	3	5	38.67 ± 1.65
Class 2	C3-H	16-19	5	8	35 ± 2.65
		19-22	2	3	40 ± 2.64
		22-25	1	2	39 ± 1.32
	H-Rgn	16-19	5	8	37.6 ± 2.35
		19-22	3	5	36.33 ± 2.96
		22-25	4	7	37.5 ± 1.98
Class 3	C3-H	16-19	3	5	39 ± 2.54
		19-22	2	3	39 ± 1.97
		22-25	3	5	40.33 ± 2.54
	H-Rgn	16-19	4	7	39.75 ± 1.94
		19-22	3	5	38.33 ± 2.63
		22-25	5	8	40.2 ± 1.65

taken out along with the mean distance (table-III & table-IV).

Table-IV: Gender, age, skeletal class parameter and mean distance.

Skeletal Class	Parameter	Gender	Age	Frequency	Percentage	Mean ± Standard Deviation
Class 1	C3-H	Male	16-19	2	3	41.5 ± 1.24
			19-22	2	3	45.5 ± 2.14
			22-25	0	-	-
		Female	16-19	2	3	33.5 ± 1.35
			19-22	0	-	-
			22-25	3	5	37.67 ± 2.14
	H-Rgn	Male	16-19	2	3	36 ± 1.65
			19-22	3	5	34.33 ± 2.45
			22-25	1	2	34 ± 2.01
		Female	16-19	3	5	39 ± 2.65
			19-22	0	-	-
			22-25	2	3	41 ± 1.05
Class 2	C3-H	Male	16-19	1	2	35 ± 1.87
			19-22	1	2	45 ± 2.13
			22-25	1	2	39 ± 2.65
		Female	16-19	4	7	35 ± 2.98
			19-22	1	2	35 ± 1.65
			22-25	0	-	-
	H-Rgn	Male	16-19	3	5	38.67 ± 1.89
			19-22	2	3	37 ± 1.47
			22-25	2	3	39 ± 2.14
		Female	16-19	2	3	36 ± 2.98
			19-22	1	2	35 ± 2.14
			22-25	2	3	36 ± 1.69
Class 3	C3-H	Male	16-19	1	2	41 ± 1.58
			19-22	1	2	44 ± 1.69
			22-25	2	3	42.5 ± 2.69
		Female	16-19	2	3	38 ± 2.54
			19-22	1	2	34 ± 1.69
			22-25	1	2	36 ± 1.89
	H-Rgn	Male	16-19	1	2	35 ± 1.49
			19-22	3	5	38.33 ± 265
			22-25	2	3	43 ± 2.31
		Female	16-19	3	5	41.33 ± 1.36
			19-22	0	-	-
			22-25	3	5	38.33 ± 1.69

DISCUSSION

The bones of the skull borders the airway superiorly, anterosuperiotly by the nasal septum, posteriorly by the spine and anteriorly by the mandible and hyoid bone[9-11]. Hyoid bone is the one which is not communicative with the other bones[12-15]. Across the previous twenty years, considerable attention has been paid to the hyoid bone`s position in association with the facial skeleton: moreover, hyoid bone can be used as an anatomical feature linking the head`s position with the neck. It linked to the base of skull, and it is linked to the mandible on the other hand[6]. The

hyoid bone position, postoperatively may imitatethe stretching of the suprahyoid musculature which can cause the deterioration: patients who are suffering from obstructive sleep apnea have been reported to suffer from narrowing of the airway and a low position of hyoid bone[16]. It has been indicated by the research that changes in the position of hyoid be likely to be associated with the changes in mandibular position[16].

In this regard some of the previously work was studied and some of the findings are elaborated. In previous studies of Tsai[16] and Sheng *et al*[17] it has been demonstrated the effects of gender on the hyoid bone position which might activate during the adolescence period due to the active growth of teenagers. Only adult patients with permanent dentition were selected for avoiding the effects of growth on the position of the hyoid bone in this study.

Male older adults were found to be having the bigger distance between the mandible and hyoid in the comparison of younger adults; differences in the distance between hyoid and mandible with respect to the gender were only seen in older adults, larger distance was found in older males in the comparison of older females[18-19]. Linear measurement from C3 to the hyoid bone (C3-H) witnessed significantly larger in males in comparison of females in all the groups (table-I). This was in line with findings of studies by Marsan[19]. There were no any significant differences found between hyoid and the mandible (H-RGn) in any of the skeletal bases. This was also in line with finding of previously published study of Marsan[19].

In the previous research linear measurements i.e. H-RGN and C3-H were analyzed which demonstrates that the hyoid bone`s anteroposterior movement indicated no significant differences[20-21]. The overall mean of H-RGn was computed to be 44.02 ± 5.45 in one of the related research[22]. But in the present research, the overall mean was calculated to be 38 ± 3.570 which is less comparatively. In Turkish study smaller values were reported i.e. 38.83 ± 5.4523 with an age ranging from 18 to 24 years. The H-RGn value was calculated to be less for males (43.81 ± 5.38) in the comparison of females (44.17 ± 5.53). The mean values for males and females were computed to be 37.56 ± 3.79 and 38.56 ± 3.48 respectively. Similarly, greater values for H-RGn were found in females when they were compared with males[21]. In male, the hyoid bone is positioned at higher level as compared to females in each of the class groupwhich is in line with results obtained by Kollias and Krogstad[12] and longitudinal studies by Sheng *et al*[18]. Furthermore, the significant higher hyoid angle was found in males in comparison to females which was not reported in earlier studies. In females, the hyoid bone is located more superior and posterior in the comparison fo males and its positionvaries with the variation in skeletal classes. It is placed more subsequent in patterns of skeletal class II and more substandard and anterior in the patterns of skeletal class I[6]. The position of hyoid bone could be a good diagnostic guide to malocclusions provoked by destructive oral habits such as atypic deglutition or mouth breathing[24].

LIMITATION OF STUDY

The limitation of the study is small sample size and the reason for this was the limited time duration for the conduction this study.

Gender, age and skeletal class was the only data which have been collected from the patients; for the extension of this study and more deep analysis, more data can be collected for example, BMI and the anthropometric measurements.

CONCLUSION

In comparison to females, C3-H and H-Rgn were greater in males in all the class groups. Additionally, there is a greatest distance was found in C3-H in males in class 1 and 3.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

REFERENCES

1. Tseng YC, Lai S, Lee HE, Chen KK, Chen CM. Are hyoid bone and tongue the risk factors contributing to postoperative relapse

for mandibular prognathism? Bio Med Res Intl 2016; 2016: 5284248.
2. Wahaj A, Gul-e-Erum, Ahmed I .Comparison of hyoid bone position among cleft lip palate and normal subjects. J Coll Physicians Surg Pak 2014; 24(10): 745-48.
3. Chauhan A, Autar R, Pradhan KL, Yadav V. Comparison of pharyngeal airway dimension, tongue and hyoid bone position based on ANB angle. Natl J Maxillofac Surg 2015; 6(1): 42-51.
4. Cabral MB, de Freitas AC, de Araújo TM, Pena N, Brandao-Filho RA. Effects of chin advancement surgery in hyoid bone and tongue positions and in the dimension of the oropharynx. Dental Press J Orthod 2013; 18(5): 64–69.
5. Sahoo NK, Jayan B, Ramakrishna N, Chopra SS, Kochar G. Evaluation of upper airway dimensional changes and hyoid position following mandibular advancement in patients with skeletal class II malocclusion. J Craniofac Surg 2012; 23(6): e623-27.
6. Mortazavi S, Asghari-Moghaddam H, Dehghani M, Aboutorabzade M, Yaloodbardan B, Tohidi E, et al. Hyoid bone position in different facial skeletal patterns. J Clin Exp Dent 2018; 10(4): e346-51.
7. Feng X, Todd T, Hu Y, Lintzenich CR, Carr JJ, Browne JD, et al. Age-related changes of hyoid bone position in healthy older adults with aspiration. Laryngoscope 2014; 124(6): e231-36.
8. Urzal V, Braga AC, Ferreira AP. Hyoid bone position and vertical skeletal pattern open bite/deep bite. Oral Health Dent Manag 2014; 13(2): 341-47.
9. Asem A, Bhattacharya P, Ansar J, Agarwal DK, Bhandari R. Effects of functional therapy on hyoid bone, pharyngeal airway and tongue position in class II patients. Ind J Orthod Dentofacial Res 2018; 4(1): 41-44.
10. Verma G, Tandon P, Nagar A, Singh GP, Singh A. Cephalometric evaluation of hyoid bone position and pharyngeal spaces following treatment with Twin block appliance. J Orthod Sci 2012; 1(3): 77-82.
11. Jose NP, Shetty S, Mogra S, Shetty VS, Rangarajan S, Mary L. Evaluation of hyoid bone position and its correlation with pharyngeal airway space in different types of skeletal malocclusion. Contemp Clin Dent 2014; 5(2): 187-89.
12. Jiang YY. Correlation between hyoid bone position and airway dimensions in Chinese adolescents by cone beam computed tomography analysis. Int J Oral Maxillofac Surg 2016; 45(7): 914–21.
13. Kim MA, Kim BR, Choi JY, Youn JK, Kim YJ, Park YH. Three-dimensional changes of the hyoid bone and airway volumes related to its relationship with horizontal anatomic planes after bimaxillary surgery in skeletal Class III patients. Angle Orthod 2013; 83(4): 623-29.
14. Arslan SG, Dildeş N, Kama JD. Cephalometric investigation of first cervical vertebrae morphology and hyoid position in young adults with different sagittal skeletal patterns. Sci World J 2014; 159(1): 784-88.
15. Jose NP, Shetty S, Mogra S, Shetty VS, Rangarajan S, Mary L. Evaluation of hyoid bone position and its correlation with pharyngeal airway space in different types of skeletal malocclusion. Contemp Clin Dent 2014; 5(2): 187-89.
16. Tsai HH. The positional changes of hyoid bone in children. J Clin Pediatr Dent 2002; 27(1): 29-34.
17. Sheng CM, Lin LH, Su Y. Developmental changes in pharyngeal airway depth and hyoid bone position from childhood to young adulthood. Angle Orthod 2009; 79(3): 484-90.
18. Feng X, Todd T, Hu Y, Lintzenich CR, Carr JJ, Browne JD, et al. Age-related changes of hyoid bone position in healthy older adults with aspiration. Laryngoscope 2014; 124(6): e231-36.
19. Marsan G. Head posture and hyoid bone position in adult Turkish Class III females and males. World J Orthod 2008; 9(4): 391-98.
20. Nuvusetty B, Peddu R, Prakash AS, Kalyani M, Devikanth L, Chadalawada D. Assessment of changes in pharyngeal airway size and hyoid bone position following orthodontic treatment of Class I bimaxillary dentoalveolar protrusion. J Ind Orthodont Soc 2016; 50(4): 215-21.
21. Daraze A. Cephalometric Evaluation of the Hyoid Bone Position in Lebanese Healthy Young Adults. J Contemp Dent Pract 2018; 19(5): 490-501.
22. Malkoc S, Usumez S, Nur M, Donaghy CE. Reproducibility of airway dimensions and tongue and hyoid positions on lateral cephalograms. Am J Orthod Dentofac Orthop 2005; 18(4): 513-16.
23. Soheilifar S, Momeni MA. Cephalometric comparison of position of the hyoid bone in class i and class ii patients. Iran J Ortho 2017; 12(1): e6500.
24. Verma G, Tandon P, Nagar A, Singh GP, Singh A. Cephalometric evaluation of hyoid bone position and pharyngeal spaces following treatment with Twin block appliance. J Orthod Sci 2012; 1(3): 77-82.