

Comparison of Hyoid Bone Position Among Cleft Lip Palate and Normal Subjects

Aiysha Wahaj, Gul-e-Erum and Imtiaz Ahmed

ABSTRACT

Objective: To compare the hyoid bone position between cleft lip/palate and normal patients.

Study Design: Cross-sectional analytical study.

Place and Duration of Study: Dr. Ishrat-ul-Ebad Khan Institute of Oral Health Sciences (DIEKIOHS), Dow University of Health Sciences (DUHS), Karachi, from March 2012 to February 2013.

Methodology: The sample for this study consisted of total 68 subjects among which Group 1 consisted of 34 non-syndromic cleft lip and palate (both unilateral and bilateral) and Group 2 included 34 subjects with normal facial morphology. Both groups included males and females with mean age 14.3 ± 0.1 year. Analysis was done on lateral cephalometric radiographs of patients including angulations taken as Hp-Mp, Hp-Ol, Hp-Sn, Cvt-Evt, Opt-Cvt, Nke, Sn-Vert, Cvt-Vert, Sn-Vert and linear distance of hyoid bone measured as C3-H, C3-RGN, and H-RGN.

Results: Statistically significant differences [$p < 0.001$] in C3-H, C3-Rgn, H-Rgn, and Sn-Cvt were found between cleft lip/palate group and normal group.

Conclusion: Hyoid bone is located anteriorly and caudally in cleft lip and palate group.

Key Words: *Hyoid bone. Cleft lip palate. Normal occlusion.*

INTRODUCTION

Complex stomatognathic system, meditates upon substantial anatomical and physiological craniofacial growth theories. There are paramount discussions in order to understand whole functioning in individuals. Hyoid bone morphology, function and position is also considered to be vital in relation to the cranium and the cervical spine and variability is found between individuals.^{1,2}

The hyoid bone has no bony articulation. Its anatomical boundary lies above the floor of the mouth and tongue, below the larynx and posteriorly the epiglottis and pharynx. Muscles attached to the hyoid bone includes supra hyoid, infra-hyoid, pharyngeal muscles etc., which provide range of functions including airway, swallowing and prevent regurgitation.¹⁻⁶ Variation in position of the hyoid bone affects vital functions in relation to the craniofacial structures and head posture.⁷⁻⁹ In order to open closed pharyngeal airway, infants need to exert additional force compared with that required to maintain its patency, presumably because of airway wall adhesion.^{10,11} In cleft lip and palate group, 17% of the infants hyoid bone show no ossification; whereas all the normal infants have normal ossification in this regard.¹²

Verin *et al.* described that differences in hyoid bone position too caudally might induce upper airway resistance.¹³ Also, transpalatal resistance was correlated with greater hyoid to mandibular plane distance. It has been discussed that increasing airway resistance cause hyoid bone to become lower. Further hyoid bone position changes with age as it descends during growth and maintains its position between C3 and C4. A steady descent is also found during adolescent growth. Lower hyoid bone position at all ages is also found in snoring sleep apnea subjects.

Clinicians should consider diversities of the hyoid bone because of the functional and clinical importance of its variations and abnormal relations corresponding to surrounding structures.

The aim of this study was to compare the difference in hyoid bone position between subjects with cleft lip/palate and without.

METHODOLOGY

This cross-sectional study was undertaken to investigate the position of the hyoid bone in cleft lip and palate and normal individuals. Data was collected from patients coming to dental orthodontic department for routine orthodontic treatment at Dr. Ishrat-ul-Ebad Khan Institute of Oral Health Sciences (DIEKIOHS) and Dow University of Health Sciences (DUHS), Karachi, a major tertiary care centre in Karachi. Sample size of cleft lip/palate subjects was estimated by using cleft lip/palate prevalence of 1.91% in Pakistan with confidence level 95%, and 5% of marginal error. The sample for this

Department of Orthodontics, Dr. Ishrat-ul-Ebad Khan Institute of Oral Health Sciences, Dow University of Health Sciences, Karachi.

Correspondence: Dr. Aiysha Wahaj, Department of Orthodontics, Dr. Ishrat-ul-Ebad Khan Institute of Oral Health Sciences, Dow University of Health Sciences, Karachi.

E-mail: aiyshwj@gmail.com

Received: March 07, 2013; Accepted: June 06, 2014.

study consisted of total 68 subjects among which Group 1 included 34 subjects with cleft lip and or / palate and Group 2 included 34 subjects with normal facial morphology (both males and females). Informed consent was taken from all patients.

Inclusion criteria for cleft lip and palate group included non-syndromic adolescent subjects with complete surgically repaired cleft lip and palate. Exclusion criteria included subjects with auto-immune diseases, immunocompromised state, unrepaired cleft lip or palate, open fistulas, syndromes, endocrine abnormalities, neurological problems and previous orthodontic treatment.

Inclusion criteria for normal adolescent subjects included Class-I skeletal base and dental Angle's Class-I while exclusion criteria included subjects with autoimmune diseases, immunocompromised state, syndromes and previous orthodontic treatment.

All the analysis was done on lateral cephalometric radiographs of patients including the following angulations and linear measurements.⁷

Angulations given were: hyoid plane to mandibular plane angle [Hp-Mp], hyoid plane to occlusal line angle [Hp-OI], hyoid plane to sella-nasion line angle [Hp-Sn], angle between cervical vertebral tangent and the line through cv4 and cv6 inferior and posterior part of corpus [Cvt-Evt], cervical curvature angle [Opt-Cvt], natural head position [Nke], sella-nasion to true vertical line [Sn-Vert], cervical vertebral tangent to true vertical line [Cvt-Vert] and sella-nasion to cervical vertebral tangent (Sn-Cvt).

Linear distance of hyoid bone was measured from third cervical vertebra to hyoid bone [C3-H], third cervical vertebrae to retrognathion [C3-RGN] and hyoid bone to retrognathion [H-RGN].

The collected data was analyzed using Statistical Package for Social Sciences (SPSS) version 17. Descriptive statistical analysis was done with independent two sample t-test for comparing normal and cleft lip/palate group hyoid bone position in order to generate p-value, with confidence interval of 95%.

Table I: Mean calculation between cleft and normal group.

Cephalometric variables	Cleft [n=34] Mean [±SD]	Normal [n=34] Mean [±SD]	p-value
¹ Hp-Mp [degree]	21.8 ± 4.29	22.1 ± 4.03	0.77
² Hp-OI [degree]	14.8 ± 2.20	14.2 ± 1.98	0.22
³ Hp-Sn [degree]	19.0± 3.7	18.5 ± 4.4	0.62
⁴ Cvt-Evt [degree]	14.3 ± 3.07	14.6 ± 3.7	0.67
⁵ Opt-Cvt [degree]	7.2 ± 1.13	7.1 ± 1.08	0.82
⁶ Nke [degree]	14.7 ± 4.08	16.0 ± 3.6	0.20
⁷ C3-H [mm]	32.7 ± 2.8	38.2 ± 2.6	< 0.001*
⁸ C3-Rgn [mm]	65.7 ± 2.3	75.5 ± 12.3	< 0.001*
⁹ H-Rgn [mm]	34.09 ± 1.6	46.4 ± 7.6	< 0.001*
¹⁰ Sn-Vert [degree]	81.5 ± 2.06	82.2 ± 1.7	0.15
¹¹ Cvt-Vert [degree]	15.5 ± 2.47	16.3 ± 2.29	0.15
¹² Sn-Cvt [degree]	81.6 ± 3.6	73.8 ± 7.59	< 0.001*

*p-value < 0.05 was considered as significant.

RESULTS

There is statistically significant difference in C3-H, C3-Rgn, H-Rgn and Sn-Cvt found between cleft lip/palate group and normal group (p < 0.001). While no statistically significant difference was found for hyoid bone in relation to mandibular plane [p = 0.77], occlusal plane [p = 0.22] and sella-nasion plane [p = 0.62]. The mean calculated differences and subsequent significant p-value is shown in Table I.

DISCUSSION

In this study, differences in the position of the hyoid bone were found between patients with clefts of lip, alveolus, and palate and orthodontic patients without cleft. It was also noted that there was no difference among both groups regarding facial skull growth pattern and head position [Nke p > 0.05]. These findings are not consistent with the Choi and Kaduck's findings.^{14,15}

It is well known that there are many anomalies associated with cleft patients. Lateral cephalometric radiographic interpretation shows, greater nasopharyngeal width, reduced posterior facial height, increased mandibular plane angle, and obtuse gonial angles.

In cases with upper airway resistance like cleft lip and palate, enlarged adenoids etc. mode of breathing changes from nasal to oral so that to provide airway patency. Cranio-cervical angulation is increased. This increase altogether is associated with forward postural response of the mandible and tongue. Craniocervical increase of 2 degrees is reported by Woodside *et al.* and 10 degree by Solow *et al.*^{16,17} These are concomitantly also linked with, septal deviation and surgical repair techniques. Reduction in airway till 25 - 30% is reported within cleft literature. Morphological alteration like the short ramal height, large gonial angle and a large mandibular inclination but not lower face height, shows changes which is suggestive to be as relevant factor for activating growth control mechanisms. The rami and condyles provide compensation to deficit of growth in cleft lip/palate with increase in ramal inclination which also seems to play a role in forward growth of the mandible. This study found no statistical significance with respect to vertical position like occlusal, mandibular, or hyoid plane to sella-nasion line angle but increase in Sella-Nasion to cervical vertebral tangent is suggestive of above finding.

Contrary to above discussion, cleft patients literature also presents with smaller cranio-cervical angle than the normal, describing head with flexion.¹⁸⁻²² In these patients small cranio-cervical angle is associated with decreased face height with increased mandibular prognathism and decreased mandibular plane inclination, whereas increased craniocervical angle in patients represented with increase anterior face height, maxillomandibular retrognathism and increased mandibular plane inclination indicate craniocervical

angulations related to mandibular development. This explained that the craniocervical angle decreases with 0.5 degree in flexion of the head and with marked forward growth rotation of the mandible. Further, cleft lip and palate patients mostly show midface retrusion with mandibular prognathism. This characteristic feature might be associated with change in head posture which is correlated with neuromuscular balance. This study did not find any significant relevance to head flexion. This might be associated with limited available sample size.

The position of the hyoid bone is described and discussed variably within the illustrated cleft literatures,²³⁻²⁵ so that position of the hyoid and associated anatomical morphology, predictably provide availability for functional movements as it implicates to seal the nasopharynx or to maintain the airway. Hence, it suggests that caudal and anterior location of the hyoid in patients with cleft should not be considered an associated anomaly. The present findings are not consistent with this and show relevance in relation to alteration in the morphology and position of the hyoid bone which subsequently presents significant potential problems in terms of breathing, swallowing and possibly head posturing because of alterations in the attachment and pull of the muscles responsible for these function. Furthermore, this may also lead towards the hypothesis that the position of the hyoid bone is altered in all cleft (unilateral and bilateral) patients with respect to mandibular and occlusal planes or with anomalies associated with first and second branchial arch. This study did not find any significant relevance to it, although pattern of airway/breathing, deglutition and head posture may become affected because of suprahyoid, infrahyoid muscles or muscular triangle of neck, indicating functional adaptability related to it. This requires three dimensional evaluation to identify such changes.

Above discussed studies described the significance of hyoid bone in maintaining patency of the upper respiratory tract and its three-dimensional position in relation to the surrounding structures. A lowered position of hyoid with a greater dorsal inclination of the head was noted in mouth-breathing children with enlarged palatine tonsils. Further findings also elaborated inferior position of the hyoid bone in the open mouth position in combination with an increased dorsal inclination of the head. This study did not include mouth breathing subjects but change in hyoid position is found as caudal and anterior in cleft (both unilateral and bilateral) subjects. The difference in position of hyoid bone is also studied by others.^{9,22-24} Altogether they concluded significant differences in the position of the hyoid between patients with normal occlusion and dysgnathic patients.

CONCLUSION

Hyoid bone is located anteriorly and caudally in cleft lip and palate group. Change in sella-nasion plane has no

effect on the position of hyoid bone. Change in hyoid bone position affects normal head position in both unilateral and bilateral cleft lip and palate which shows head extension as compared to normal group.

REFERENCES

1. Matsuo K1, Palmer JB. Anatomy and physiology of feeding and swallowing: normal and abnormal. *Phys Med Rehabil Clin N Am* 2008; **19**: 4:691-707.
2. Wermker K. Nasopharyngeal development in patients with cleft lip and palate. *Int J of Otolaryng* 2012; **12**:1-8.
3. Karayazgan B, Gunay Y, Gurbuzer B, Erkan M, Atay A. Pre-operative appliance for a newborn with cleft palate cleft palate. *Craniofac J* 2009; **46**:53-7.
4. Miller KW, Walker PL, O'Halloran RL. Age and sex-related variation in hyoid bone morphology. *J Forensic Sci* 1998; **43**: 1138-43.
5. Richard WE. Otolaryngologic. *Clin North Am* 2000; **33**: 1191-215.
6. Stepovich ML. A cephalometric positional study of the hyoid bone. *Am J Orthod* 1965; **51**:882-900.
7. Athanasiou AE. Orthodontic cephalometry. London: Mosby-Wolfe. 1995.
8. Solow B, Tallgren A. Natural head position in standing subjects. *Acta Odont Scand* 1971; **29**:591-607.
9. Solow B, Tallgren A. Head posture and craniofacial morphology. *Am J Phys Anthropol* 1976; **44**:417-36.
10. Wilson SL, Thach BT, Brouillette RT, Abu-Osba YK. Upper airway patency in human infant: influence of airway pressure and posture. *J Appl Physiol* 1980; **48**:500-4.
11. Wilson SL, Thach BT, Brouillette RT, Abu-Osba YK. Co-ordination of breathing and swallowing in human infants. *J Appl Physiol* 1981; **50**:851-8.
12. Rajion ZA1, Townsend GC, Netherway DJ, Anderson PJ, Hughes T, Shuaib IL, *et al*. The hyoid bone in Malay infants with cleft lip and palate. *Cleftpalate Craniofac J* 2006; **43**: 532-8.
13. Verin E1, Tardif C, Buffet X, Marie JP, Lacoume Y, Andrieu-Guitrancourt J, *et al*. Comparison between anatomy and resistance of upper airway in normal subjects, snorers and OSAS patients. *Respiration Physiol* 2002; **129**:335-43.
14. Cho IJ. A cephalometric study on the position of the hyoid bone in cleft lip and palate individuals. *Koren J Orthod* 1990; **20**: 197-207.
15. Kaduk WM, Grabowski R, Gundlach KK. Position of the hyoid bone in cleft lip, alveolus, and palate: variation of normal anatomy or sign accompanying the malformation? *Cleftpalate Craniofac J* 2003; **40**:1-5.
16. Solow B, Sandham A. Cranio-cervical posture: a factor in the development and function of the dentofacial structures. *Eur J Orthod* 2002; **24**:447-56.
17. Woodside DG, Linder-Aronson S. The channelization of upper and lower anterior face heights compared to population standard in males between ages 6 to 20 years. *Eur Orthod* 1979; **1**:214-23.
18. Bardach J, Eisbach KJ. The influence of primary unilateral cleft lip repair of facial growth. Part I: Lip pressure. *Cleft Palate Craniofacial J* 1977; **14**:88-97.

19. Kumar R, Sidhu SS, Kharbanda OP, Tandon DA. Hyoid bone and atlas vertebra in established mouth breathers: a cephalometric study. *J Clin Pediatr Dent* 1995; **19**:191-4.
20. Kawakami M, Yagi T, Takada K. Maxillary expansion and protraction in correction of midface retrusion in a complete unilateral cleft lip and palate patient. *Angle Orthod* 2002; **72**: 355-61.
21. Ravera MJ, Miralles R, Santander H, Valenzuela S, Villaneuva P, Zúñiga C. Comparative study between children with and without cleft lip and cleft palate, Part 2: Electromyographic analysis. *Cleft Palate Craniofacial J* 2000; **37**:286-91.
22. Kaduk WM, Grabowski R, Gundlach KK. Position of the hyoid bone in cleft lip, alveolus, and palate: variation of normal anatomy or sign accompanying the malformation? *Cleft Palate Craniofacial J* 2003; **40**:1-5.
23. Adamidis IP, Spyropoulos MN. Hyoid bone position and orientation in Class I and Class III malocclusion. *Am J Orthod Dentofacial Orthop* 1992; **101**:308-12.
24. Haralabakis NB, Toutountzakis NM, Yiagtzis SC. The hyoid bone position in adult individuals with open bite and normal occlusion. *Eur J Orthod* 1993; **15**:265-71.
25. Solow B, Siersbaek-Nielsen S. Growth changes in head posture related to craniofacial development. *Am J Orthod* 1986; **89**:132-40.





本文献由“学霸图书馆-文献云下载”收集自网络，仅供学习交流使用。

学霸图书馆（www.xuebalib.com）是一个“整合众多图书馆数据库资源，提供一站式文献检索和下载服务”的24小时在线不限IP图书馆。

图书馆致力于便利、促进学习与科研，提供最强文献下载服务。

图书馆导航：

[图书馆首页](#) [文献云下载](#) [图书馆入口](#) [外文数据库大全](#) [疑难文献辅助工具](#)