

# Evaluation of Hyoid Position in Children of 7-11 Years Old with Ankyloglossia in Lateral Cephalometric Radiographs

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## ABSTRACT

**Introduction:** Ankyloglossia is an anatomic developmental anomaly determining by thick and short, fibrotic frenum. Tongue changes have severe effects on occlusion and oropharyngeal structures. The aim of this study was to evaluate the position of hyoid in children 7-11 years` old with ankyloglossia in lateral cephalometric radiographs.

**Materials and Methods:** 30 radiographs of children with ankyloglossia with mean age of 9.8 and 30 radiographs of control group were chosen and matched in terms of age, sex, class of malocclusion and growth pattern. The measurements of hyoid position were done (C3-RGN, C3-H, H-RGN, HP) and analyzed with paired t-test under SPSS-15 software.

**Results:** The means of C3-RGN, C3-H, H-RGN, HP were 66.2, 30.9, 33.4, 3.2 and 7.45, 36.8, 34.1, 68.6 in ankyloglossia and control groups respectively. Lower amount of measurements were statistically significant ( $p$ -value<0.05).

**Conclusion:** Size and position of hyoid in children with ankyloglossia show more posterior- superior Position than healthy children.

**Keywords:** Ankyloglossia, Hyoid, Lateral cephalometry

## Abbreviations and definitions in the study:

### Airway Passages and Tongue

Valeculla (V) = Meeting point of tongue root and epiglottis, H = Most anterior point of tongue in relation to line joining V and T, Upper pharyngeal wall (UPW) = Intersection point of pmp\_ba line and posterior wall of the pharynx, Middle pharyngeal wall (MPW) = Intersection point of perpendicular line from U

and posterior wall of the pharynx, Lower pharyngeal wall (LPW) = Intersection point of perpendicular line from V and posterior wall of the pharynx, PMP = Perpendicular line from intersection point of anterior and posterior wall of pterygomaxillary fissure to palatal plane, Pmp-U = Distance between Pmp and U (Tip of the uvula) that depicts the long axis and length of the soft palate, V-T = Distance between V and T (Tongue top) that depicts the length of the tongue, H'⊥VT = Perpendicular distance from

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H' to VT that depicts the height of the tongue, Pmp-upw = The shortest distance between Pmp and upw that depicts the nasopharyngeal airway, U-Mpw = Distance between U and mpw that depicts the oropharyngeal pathway, V-Lpw = Distance between V and Lpw that depicts the oropharyngeal pathway, PAS min = The shortest distance between base of the tongue and the posterior wall of the pharynx, V-FH = Perpendicular distance from V to FH that depicts the perpendicular position of the vallecula, V-C3 = Distance between V and C3 that depicts the horizontal position of the vallecula, SPT = Maximum thickness of the soft palate that is measured by perpendicular plotting on the PMP-U line, Pmp-V = Distance between Pmp and V that depicts vertical airway length, Pmp-u/NL = soft palate long axis in relation to the nasal line, V-T/FH = Long axis of the tongue in relation to the Frankfurt plane

#### Hyoid Position

C3 = Most anterior and the inferior point on the C3 cervical bone of the spinal column, H (Hyoid) = Most anterior-superior point on the hyoid bone, Retrognathion (RGN) = Most posterior point on the posterior border of the mandibular symphysis, C3-RGN = Distance between C3 and most posterior point on the posterior border of the mandible, H $\perp$ C3-RGN = Perpendicular distance from H on the C3-RGN line that depicts the perpendicular position of the hyoid, C3-H and H-RGN = Depicts the horizontal position of the hyoid

## INTRODUCTION

**A**nkyloglossia is a congenital oral anomaly which is determined by abnormal shortening of lingual frenum (1). It is divided into complete and partial types. In complete type tongue is completely attached to the floor of the mouth but in partial type lingual frenum is shorter than normal (2). Partial type is more common than complete (3). Severe Ankyloglossia interferes with sucking, swallowing and speech (4). But this does not cause delay and insufficiency in speech (5). Diastema between mandibular central teeth is one of the major dental problems is produced by ankyloglossia. Other potential problems are anterior open-bite, probable impact on pharyngeal structures and its position (6,7).

Kotlow LA et al noted that ankyloglossia could cause social consequences on suffering children (8).

Epker studied changes in tongue and hyoid position subsequent to mandibular advancement. The results showed that there is no significant correlation between tongue and hyoid position (9). Kitahora evaluated airway and hyoid position of patient with CL III malocclusion after orthosurgery. The results showed that hyoid moved to superior–anterior position after mandibular rewinding (10).

Adamidis LP compared the hyoid position of CL I and III malocclusion and found that there are significant differences in hyoid position among these two malocclusions (11).

In Haralabakis et al study hyoid bone position in adults with open bite and normal occlusion was evaluated. The results showed distance of hyoid bone to palatal plane in long face group is significantly longer than normal population (12).

Results of Ravanmehr and Abdollahi studies showed that the hyoid is more anterior in CL III and more superior in CL II malocclusions (13).

Erdin in his study punctuated on more superior and posterior position of hyoid bone in patient with vertical pattern growth (14). Vieira resulted that in children with obstructive sleep apnea syndrome (OSAS) hyoid moves to anterior – inferior position (15). Chaves in his study found that changes in hyoid position among asthmatic children is more than mouth breather children (16). Tsai found that there was an expectable relationship between hyoid position and growth stages (17). This study was done aiming to compare the hyoid position in children with Ankyloglossia to normal children. □

## MATERIAL AND METHOD

**T**his was a cross sectional descriptive retrospective study conducted in pediatric ward of faculty of dentistry, Shahid Sadoughi University of Yazd, Iran. In this study lateral cephalometric radiographs of patients were referred to this center were surveyed.

Radiographs which were taken in standard condition (lips in rest, Teeth in occlusion and in NHP (Natural Head position)) by PM-2002 and Kodak films were chosen.

Thirty lateral cephalometric radiographs of patients with ankyloglossia ageing between

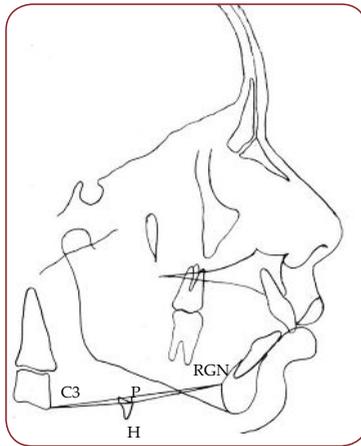


FIGURE 1. Tracing patient with ankyloglossia

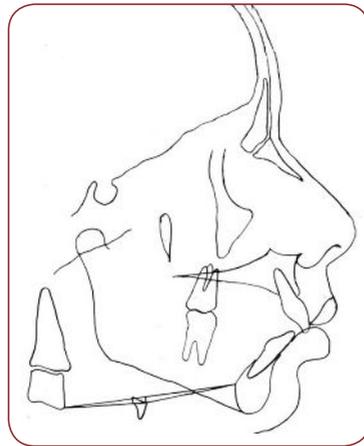


FIGURE 2. Tracing of control group

7-11 years and 30 radiographs of normal patient which were matched based on age, sex, malocclusion (based on wits -ANB), growth pattern (based on FMA, GO-GN-SN, Jarabak's index) were evaluated. Tracing of radiographs were done with dentaurem acetate tracing paper and a pen. The points and then plans and angles were drawn and cephalometric indices of hyoid (hyoid triangle) were evaluated (Table 1) and compared between two groups (Figure 1,2). Ten radiographies were traced again randomly. Data were analyzed by SPSS (Ver.14) software with paired T-test. □

## RESULTS

Two of thirty patients in ankyloglossia group had complete ankyloglossia and twelve of them had partial ankyloglossia. Remaining of them had undetermined types of ankyloglossia (not assigned in their treatment folders).

Based on Table 1 in ankyloglossia group mean of C3-RGN ( $66.23 \pm 4.56$ ), C3-H ( $30.9 \pm 2.6$ ), HP ( $3.2 \pm 2.13$ ) and H-RGN ( $33.43 \pm 3.35$ ) were less than these values in control group ( $68.56 \pm 5.41$ ), ( $84.13 \pm 3.69$ ), ( $7.45 \pm 1.26$ ), ( $36.83 \pm 2.33$ ) respectively) (P-Value < 0.05).

According to Table 2 the majority of patients in ankyloglossia group were skeletal CL II with vertical growth pattern (long face). Only two (6.66%) had skeletal CL III and three had normal growth pattern. □

## DISCUSSION

Clinical importance of ankyloglossia is about disturbances in Speech, difficulty in swal-

lowing, orthodontic disorders and periodontal problems (4). On the other hand, tongue is connected to hyoid bone by hyoglossus and chondroglossus muscles and changes in one structure (tongue or hyoid) may cause changes in the other structures (18). So changes in hyoid position are expected in ankyloglossia patients.

Because of higher prevalence of ankyloglossia in men the most cases with ankyloglossia in our study were boys. As hyoid position fixes adjacent to the inferior part of the third cervical vertebra at third year of life, and subsequent changes are low (18), difference in position of hyoid is not expected in 7-11 years.

To determine type of malocclusion we used wits and ANB indices, we had ten CL I patient (Mean of wits (-0.35 mm)), two CL III (mean of wits (-3mm)) and eighteen CL II (mean of wits (+3.2mm)). To determine growth pattern we used FMA Go-Gn-SN and Jarabak's index, there were 23 patient with vertical, four with horizontal and three patients with normal growth pattern.

To determine hyoid position C3, RGN and H points which make hyoid triangle were used. This triangle stabilized hyoid position in three dimensional plans (19). Small variation in hyoid position will be magnified by far distance of intra cranial planes to hyoid bone. So inter cranial plans were not used in determining hyoid position (19). H- C3 and H-RGN are used for evaluation of Ant-post position of hyoid which was 30.9 mm and 34.13 mm in case and 33.43, 36.83 mm in control groups, the difference was significant between study groups (P-value < 0.001).

For evaluation of Vertical position of hyoid bone, perpendicular distance of H point to C3-RGN line was measured. Mean difference between ankyloglossia group (3.2mm) and control group (7.45 mm) was statically significant (p value = 0.045). Lower C3-RGN value in ankyloglossia group indicates backward position of mandible comparing to control group.

Assuming fixed position of C3, lower C3-H value in ankyloglossia group describes posterior position of hyoid bone in ankyloglossia patients. Significant lower HP value in case group indicate higher position of hyoid bone in patient with ankyloglossia compared to control group. Lower H-RGN value in ankyloglossia group is indicative of superior position of hyoid bone and posterior position of mandible than

	Mean	N	Std. Deviation	Std. Error Mean	Paired Differences		P-value
					Mean	Std. Deviation	
Pair 1 C3RGN.T*	66.23	30	4.56	0.83	-2.33	6.08	0.045
C3RGN.C*	68.56	30	5.41	0.98			
Pair 2 HRGN.T	33.43	30	3.35	0.61	-3.40	3.48	<0.001
HRGN.C	36.83	30	2.33	0.42			
Pair 3 C3H.T	30.90	30	2.60	0.47	-3.23	3.49	<0.001
C3H.C	34.13	30	3.69	0.67			
Pair 4 HPT	3.20	30	2.13	0.38	-4.25	2.68	<0.001
HPC	7.45	30	1.26	0.23			

C: control      T: test\*

TABLE 1. Mean and S.D and S.E of C3-RGN,RGN-H,C3-H,H-P and their mean paired differences between 2 groups

	Class I		Class II		Class I		Class II	
	Number	%	Number	%	Number	%	Number	%
Vertical growth pattern	7	23/33%	41	46/66%	2	6/66%	23	76/66%
Horizontal growth pattern	2	6/66%	2	6/66%	0	0%	4	3/33%
Normal growth pattern	1	3/33%	2	6/66%	0	0%	3	10%
Total	10	33/33%	18	60%	2	6/66%	30	100%

TABLE 2. Distribution of ankyloglossia patients based on skeletal pattern

protrusive position of hyoid bone. According to results size and position of hyoid in study group show more posterior superior position than control group. So in ankyloglossia group height and sides of triangle were lower significantly which explains superior and posterior position of hyoid in patients with ankyloglossia.

Based on other studies vertical relations of hyoid are more variable than horizontal relations (19). Furthermore changes in vertical hyoid position are induced more by change in mandibular position and horizontal changes by craniocervical angle and cervical axial inclination.

According to results of present study it is expected that patient with ankyloglossia have smaller mandible with more back ward (clock wise) rotation and superior – posterior position of hyoid. Studies on hyoid position mainly focused on operated patient with skeletal problems, and to our knowledge there is no other study similar to ours.

The result of this study may indicate dependent relation between hyoid and tongue position that corroborate results of Tsai which concluded that exaggerated changes in anatomic position of tongue is concomitant with changes in hyoid position (17).

This study shows more retruded mandibular position in most of ankyloglossia patient. Based on Kitahura study, when mandible rewinds hyoid moves to forward and upward. Changes in vertical position of hyoid along with backward rotation of mandible is in accordance with our results (10). Epker and Labance found that after treatment of tongue to a more inferior and anterior position hyoid will move forward and insignificantly upward that somewhat can be similar to our results (9). Ravanmehr and Abdollahi has shown that hyoid bone has superior position in CL II patient that is similar to our study (13).

Erdin et al in their study showed superior and posterior position of hyoid in patient with vertical growth pattern (14); while the study of Viera reports more anterior position of hyoid that is not in accordance with our results (15). In Haralabakis study an increase in distance of hyoid to palatal plan in patient with vertical growth pattern was seen that is different from our study (12).

Our study showed that hyoid in ankyloglossia group is in superior and posterior position which can causes backward and downward rotation of mandible. There are few article refer

to ankyloglossia's role in breath disorders and dyspnea (7). Superior position of hyoid triangle in children with mild or moderate asthma and mouth breathing was shown by Chavas et al (16). Superior position of hyoid in ankyloglossia patients was confirmed in our study possibility can cause dyspnea in this patients. □

## CONCLUSION:

Based on present study there is a significant correlation between hyoid and tongue position. Hyoid bone in ankyloglossia patient moves upward and backward while mandible move back ward. □

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