ORIGINAL RESEARCH

Assessment and Comparison of Tongue Posture in Individuals with Different Vertical Facial Patterns

[1]Ravi M Subrahmanya, [2]Swathi Gupta

ABSTRACT

Background and objectives: It is established that the posture of the tongue can also influence the dental relationship and facial skeletal pattern of an individual. Hence, this study was designed and planned to assess the posture of tongue in individuals with different skeletal patterns in vertical plane in order to help us to understand the relationship between the tongue posture and the growth pattern of an individual.

Materials and methods: Sixty subjects (30 males and 30 females) in the age group of 16 to 20 years were selected as per inclusion criteria. They were divided into two groups (Groups I and II) according to their skeletal pattern in vertical plane based on Jarabak's ratio and Y-axis. Tongue posture measurements were done using a template based on Rakosi analysis. The data obtained were statistically evaluated by using Mann-Whitney U test (Z test) to test the significance of difference in the tongue posture in subjects with horizontal and vertical skeletal pattern.

Results: The dorsum of the tongue was found to be higher in subjects with vertical skeletal pattern at all points. There was no significant difference in the distance between soft palate and root of the tongue. There was no significant difference in the position of tongue tip between the groups.

Conclusion: The study supports the existence of a relationship between the posture of the tongue and the skeletal facial pattern in vertical plane.

Keywords: Skeletal pattern, Tongue posture, Vertical plane.

How to cite this article: Subrahmanya RM, Gupta S. Assessment and Comparison of Tongue Posture in Individuals with Different Vertical Facial Patterns. J Orofac Res 2014;4(2):67-71.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

It is established that the posture of the tongue can also influence the dental relationship and facial skeletal pattern of an individual.[1]

[1]Professor, [2]Consultant

[1]Department of Orthodontics, AB Shetty Memorial Institute of Dental Sciences, Mangalore, Karnataka, India

[2]Department of Orthodontics, Verma Dental Clinic, Indore Madhya Pradesh, India

Corresponding Author: Ravi M Subrahmanya, Professor Department of Orthodontics, AB Shetty Memorial Institute of Dental Sciences, Mangalore, Karnataka, India, Phone: 08242204572, e-mail: drmsravi@gmail.com

Many clinical situations such, as nasal obstruction secondary to hypertrophied inferior turbinates, adenoidal pad hypertrophy and hypertrophy of the faucial tonsils can cause chronic mouth breathing, loud snoring, obstructive sleep apnea, excessive daytime sleepiness and even corpulmonale. In these situations, a number of postural changes, such as open mandible posture, downward and forward positioning of the tongue and extension of the head can take place.[2] If these postural changes continue for a long period especially during the active growth stage, dentofacial disorders at different levels of severity can be seen together with the inadequate lip structure, long face syndrome and adenoidal facies.[2]

Hence, this study was designed and planned to assess the posture of tongue in individuals with different skeletal patterns in vertical plane in order to help us to understand the relationship between the tongue posture and the growth pattern of an individual.

MATERIALS AND METHODS

Sixty individuals (30 males and 30 females) in the age group of 16 to 20 years were selected as per the following criteria for subjects with different vertical growth patterns.

Inclusion Criteria

- Individuals in the age group of 16 to 20 years.
- Clinically obvious long and short faced individuals.
- Individuals with full complement of teeth up to 2nd molars.
- Individuals willing to participate in the study.

Exclusion Criteria

- Presence of any pharyngeal pathology.
- Individuals with enlarged tonsils and with history of repeated common cold.
- Individuals with complaints of nasal obstruction.
- Any craniofacial syndromes/medically unfit.
- Patients with abnormal habits.
- Patients with history of previous orthodontic treatment and/or surgical treatment.

The subjects fulfilling the above criteria were requested to participate in the study. After obtaining the informed consent, lateral cephalograms were made for each individual

in a standardized technique using the Planmeca PM 2002 cc Proline machine (Planmeca, Finland). The lateral cephalograms were traced on 0.003" acetate paper by the same operator in order to avoid interoperator errors.

The subjects were divided into two groups according to their skeletal pattern in vertical plane based on Jarabak's ratio (Posterior facial height/Anterior facial height ×100) and Y-axis (SN-Gn angle) (Table 1).

Tongue posture measurements were carried out using a template based on Rakosi analysis.[3] The following linear measurements were made on lateral cephalogram (Fig. 1).

- *Line along 1*: Distance between the soft palate and the root of the tongue.
- *Line along 2-6*: Relationship of the dorsum of the tongue to the roof of the mouth.
- *Line along 7*: Position of the tip of the tongue relative to lower incisors.

On the radiograph taken in occlusion, the space between tongue and roof of mouth is defined by distances in millimeters. The data obtained were statistically evaluated by using Mann-Whitney U test (Z test) to test the significance of difference in the tongue posture in subjects with horizontal and vertical skeletal pattern.

Table 1: Distribution of subjects into groups

Groups	No. of subjects		Mean Jarabak's ratio (%)	Mean Y-axis (Degree)
I	30	15 M	68.41	52.46
		15 F	66.69	51.8
II	30	15 M	56.77	66.13
		15 F	55.75	67.13

Table 2: Posture of the tongue in subjects with horizontal and vertical growth pattern

Posture of the tongue	Groups	No. of subjects	Mean (mm)	Std. deviation	p
Point 1	I	30	2.88	1.720	0.342 NS
	II	30	2.50	2.030	
Point 2	I	30	1.97	1.861	0.002 HS
	II	30	3.80	2.524	
Point 3	I	30	5.20	2.235	0.000 VHS
	II	30	8.07	2.420	
Point 4	I	30	5.63	2.773	0.000 VHS
	II	30	9.53	2.874	
Point 5	I	30	7.50	2.301	0.001 HS
	II	30	9.97	3.146	
Point 6	I	30	5.733	2.2273	0.000 VHS
	II	30	9.083	3.2907	
Point 7	I	30	4.97	3.746	0.209 NS
	II	30	5.87	3.481	

[p < 0.001 is very highly significant (VHS), p < 0.01 is highly significant (HS), p < 0.05 is significant (S), p > 0.05 is not significant]

RESULTS

The present study was undertaken with the intention of evaluating and comparing the posture of the tongue in subjects with different vertical growth patterns based on their Cephalometric Jarabak's ratio and Y-axis values. The data obtained were subjected to statistical analysis and the following results are drawn.

Tongue Measurements

Within the groups, no significant differences were observed in the mean values of the tongue measurements at all the points in both the males and females (Table 2).

*Distance between the Soft Palate and the Root of the Tongue at Point 1*

The difference in the mean distance values between the groups were not found to be significant (p = 0.342) (*see* Table 2, Graph 1). The difference in values was found to be not significant both in males and females (Table 3, Graph 2).

The Posture of the Dorsum of the Tongue at Point 2

The difference in the mean value of dorsum of the tongue at point 2 between the groups were found to be highly significant (p = 0.002) (*see* Table 2, Graph 1). The difference in values was found to be significant in both males and females (*see* Table 3, Graph 2).

The Posture of the Dorsum of the Tongue at Point 3

The differences in the mean values between the groups were found to be very highly significant (p = 0.000) (*see* Table 2, Graph 1). The differences in the mean values in males between the groups were found to be highly significant (p = 0.002). Whereas the differences in females between the groups were found to be significant (p = 0.015) (*see* Table 3, Graph 2).
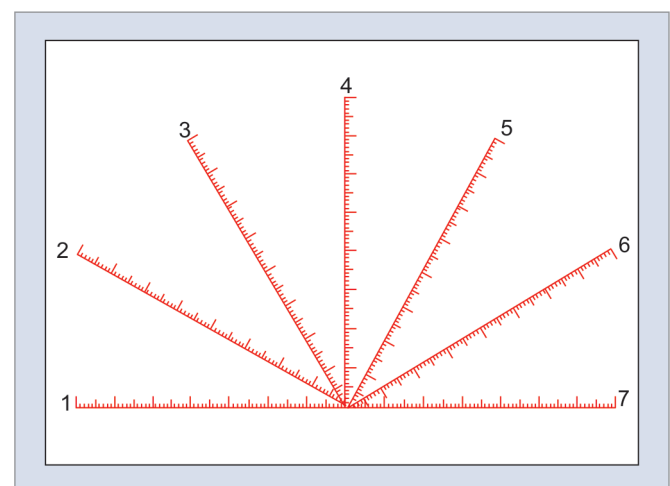

**Fig. 1:** Template used for tongue measurements (Ricketts)

Table 3: Posture of the tongue in males and females in both the groups

Posture of the tongue	Gender	Groups	No. of subjects	Mean (mm)	Std. deviation	p
Point 1	Male	I	15	2.5000	1.14953	0.983 NS
		II	15	2.6667	1.79947	
	Female	I	15	3.2667	2.12020	0.215 NS
		II	15	2.3333	2.28869	
Point 2	Male	I	15	2.1000	2.05461	0.011 S
		II	15	4.2000	2.65115	
	Female	I	15	1.8333	1.70783	0.012 S
		II	15	3.4000	2.41424	
Point 3	Male	I	15	5.0000	1.77281	0.002 HS
		II	15	8.2000	2.59670	
	Female	I	15	5.4000	2.66726	0.015 S
		II	15	7.9333	2.31352	
Point 4	Male	I	15	6.2000	3.14416	0.002 HS
		II	15	10.333	2.84521	
	Female	I	15	5.0667	2.31352	<0.001 VHS
		II	15	8.7333	2.76371	
Point 5	Male	I	15	7.9333	2.68506	0.003 HS
		II	15	10.200	2.62406	
	Female	I	15	7.0667	1.83095	0.024 S
		II	15	9.7333	3.67359	
Point 6	Male	I	15	5.6667	2.49762	<0.001 VHS
		II	15	9.3000	2.83977	
	Female	I	15	5.8000	2.00713	0.034 S
		II	15	8.8667	3.77712	
Point 7	Male	I	15	5.1333	4.25721	0.306 NS
		II	15	6.2000	3.62925	
	Female	I	15	4.8000	3.29935	0.518 NS
		II	15	5.5333	3.41983	

[p < 0.001 is very highly significant (VHS), p < 0.01 is highly significant (HS), p < 0.05 is significant (S), p > 0.05 is not significant (NS)]
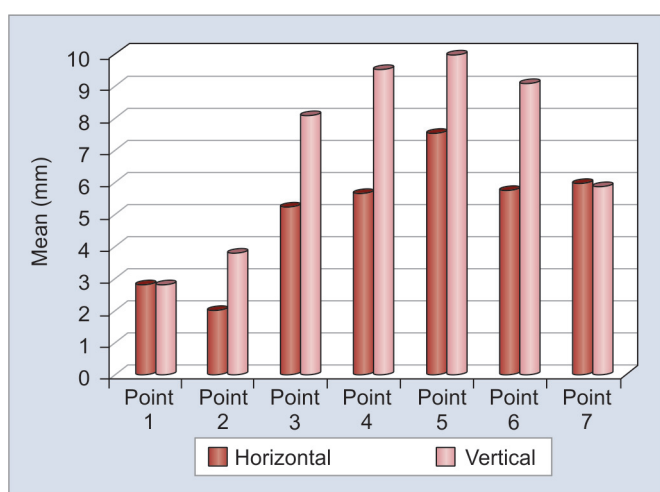
Graph 1: Tongue posture in subjects with horizontal and vertical growth patterns
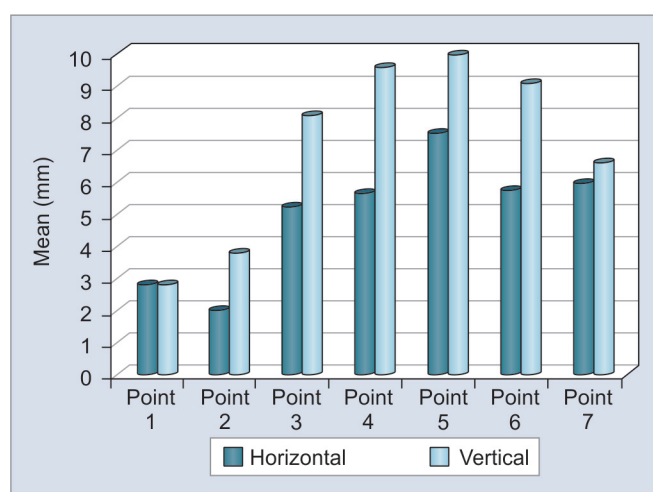
Graph 2: Tongue posture in males and females with horizontal and vertical growth patterns

The Posture of the Dorsum of the Tongue at Point 4

The differences in the mean values between the groups were found to be very highly significant (p = 0.000) (*see* Table 2, Graph 1). The differences in the mean values in males between the groups were found to be highly significant (p = 0.002). Whereas the differences in females between the groups were found to be very highly significant (p < 0.001) (*see* Table 3, Graph 2).

The Posture of the Dorsum of the Tongue at Point 5

The differences in the mean values between the groups were found to be highly significant (p = 0.001) (*see* Table 2, Graph 1). The differences in the mean values in males between the groups were found to be highly significant (p = 0.003). However, the differences in the mean values in females between the groups were found to be significant (p = 0.024) (*see* Table 3, Graph 2).

The Posture of the Dorsum of the Tongue at Point 6

The differences in the mean values between the groups were found to be very highly significant (p = 0.000) (*see* Table 2, Graph 1). In males, the differences in the mean values between the groups were found to be very high significant (p < 0.001). Whereas in females the differences between the groups were found to be significant (p = 0.034) (*see* Table 3, Graph 2).

The Position of the Tip of the Tongue Relative to the Lower Incisor at Point 7

The differences in the mean values between the groups were found to be not significant (p = 0.209). (*see* Table 2, Graph 1). The differences in the mean values between the groups were not found to be significant in males as well as in females (*see* Table 3, Graph 2).

DISCUSSION

Several studies have been done regarding tongue posture and its association with various malocclusions. According to one study, class II malocclusions are a consequence of a backward position of the tongue which impedes the respiratory function, concomitantly leading to mouth breathing. By the same analysis, the author reasoned that class III conditions are due to a more forward position of the tongue.[4]

According to a study by Solow and Tallgren, a relationship exists between the craniocervical angulation and both facial proportions and dentoalveolar proportions. It has been proposed that a forward position of the head on the neck is linked with a low position of the Mandible relative to the Maxilla and low tongue posture.[5]

According to a cephalometric study of the tongue position, the age factor must be considered in the studies of tongue position as children have a higher dorsal height than adults.[6]

According to a study by Wright et al, tongue posture is normal, when the apex of the tongue was slightly below the incisal edges of the mandibular incisors and the dorsum was visible above the teeth in all parts of the mouth.[7]

In low level, the lateral borders of the tongue were found to rest against the lingual surfaces of the lower posteriors, while in the high level, the lateral borders were found to lie above the occlusal surfaces of the lower posteriors.[7]

In literature, it has been shown that the hyoid bone and its musculature occupy a key role in the regulation of the pharyngeal airway and its position is affected by the location of both the mandible and the tongue.[8]

The majority of the studies of tongue posture have been done in anteroposterior dimensions. According to a study by Rakosi et al, the dorsum of the tongue is relatively high with class II malocclusions.[9]

According to the present study, the dorsum of the tongue was found to be significantly higher in the subjects with vertical skeletal pattern at all the points (Point 2 to 6). This finding is in agreement with a study by Elham Saleh et al according to which in individuals with vertical skeletal pattern, the anteroposterior dimensions of the airway gets narrowed and to breathe through mouth, one must maintain an oral airway and to accomplish this, the mandible and the tongue are displaced downward and backward and the head is tipped back.[9]

There was no significant difference observed in the distance between the soft palate and root of the tongue in the subjects with horizontal and vertical skeletal pattern.

There was no significant difference found in the position of the tip of the tongue in the subjects with horizontal and vertical skeletal pattern. This is not in agreement with the study by Rakosi.[3] According to which, the changes in position of the tip of the tongue relate closely to the different types of malocclusion. According to this cephalometric study[3], the tip of the tongue is retracted in cases of class III and also in class II cases with nasal breathing and even more so in cases of deep overbite. In cases of open bite, the tip of the tongue lays forward.[3]

The findings generated from the present study partly support the hypothesis that upper pharyngeal airway width is narrower in long faces in comparison to short faces and tongue posture is relatively higher in subjects with vertical skeletal pattern than with horizontal skeletal pattern. The cause of such variation can only be speculated upon and a definite cause and effect relationship is yet to be demonstrated.

Significant correlation also exists between posture of the tongue and facial skeletal pattern. So, the tongue posture also should be given importance during diagnosis and treatment planning especially in patients having growth disharmony in vertical plane.

However, whether tongue posture determines the facial skeletal pattern of an individual or the *vice versa* needs to be probed further. A further study comprising of larger sample size is required so that the actual relation can be established.

CONCLUSION

The following conclusions can be drawn from the study:
- Variations are observed in the posture of the tongue in subjects with horizontal skeletal pattern and vertical skeletal pattern.
- The dorsum of the tongue is seen to be placed higher in subjects with vertical skeletal pattern.
- A significant co-relation was also found between the facial skeletal pattern and the tongue posture.

REFERENCES

1. Fishman LS. Postural and dimensional changes in the tongue from rest position to occlusion. Angle Orthod 1969;39:109-113.
2. Ceylan I, Oktay H. A study on the pharyngeal size in different skeletal patterns. Am J Orthod Dentofac Orthop 1995;108:69-75.
3. Rakosi T. An atlas and manual of cephalometric radiography; Wolfe Medical Publications Ltd; 1982. p. 96-99.
4. Graber, Newman. Removable Orthodontic Appliance. Philadelphia: WB Saunders; 1984. p. 357-375.
5. Proffit WR. Equilibrium theory revisited: factors influencing position of the teeth. Angle Orthod 1978;48(3):175-186.
6. Peat JH. A cephalometric study of tongue position. Am J Orthod Dentofacial Orthop 1968;54(5):339-351.
7. McKee TL. A cephalometric radiographic study of tongue position in individuals with cleft palate deformity. Angle orthod 1956;26(2): 99-109.
8. Battagel JM, Johal A, LÉstrange PR, Croft CB, Kotecha B. Changes in airway and hyoid position in response to mandibular protrusion in subjects with obstructive sleep apnoea. Eur J Orthod 1999;21(4):363-375.
9. Allhaija ESA, Al-Khateeb SN. Uvulo Glosso pharyngeal dimensions in different anteroposterior skeletal patterns. Angle Orthod 2005;75(6):1012-1018.