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Position of Tongue in skeletal Class II & Class III-ACephalometric study.

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Abstract: *The disturbances of oro-facial functions lead to abnormal growth & development of the oro-facial complex. The objective of the study was to compare the tongue position in different antero-posterior skeletal pattern i.e. Class II & Class III. Using four parameter, tongue length, tongue height, relation of palatal plane to tongue and pharyngeal wall to tongue. Samples size was calculated using Cohen's formula , consisted of 102 individuals from the Out-patient department from the Post-graduate department of Orthodontics &Dentofacial Orthopaedics, Government Dental College &Hospital, Srinagar. Standardized lateral cephalograms were taken for all the subjects. The radiograph was taken by the same operator in the same machine. The lateral cephalograms were segregated into skeletal Class II & skeletal Class III using three different skeletal parameters. All the lateral cephlograms were traced and Independent t-test was used for comparison and final analysis was done using SPSS software. It was found that the length of the tongue was significantly longer in Class III subjects when compared to Class II subjects, also the tongue was placed closed to pharyngeal wall in Class II subjects compared to Class III subjects. A significant positive correlation was established between the tongue position and the Class II & Class III skeletal patterns.*

Keywords: *Tongue position, Skeletal Class II, Skeletal Class III, LateralCepahlogram.*

I. Introduction

"We are just beginning to realize how common and varied are the vicious habits of the lips and tongue, how powerful and persistent they are in causing and maintaining malocclusion, how difficult they are to overcome, and how hopeless is success in treatment unless they are overcome. "- Edward H. Angle, M. D., D. D. S.November, 1906

The theme of form –function interdependence has in recent times engaged the attention of Orthoodntists.[1,2,3,4] The oro-facial area is multifunctional, serving several functions i.e. deglutition, respiration ,gustation. The patency of the functional spaces is directly related to the postural performance of the oro-facial muscles. The oro-facial musculature is responsible for vital positional relationships that maintain a functionally adequate volume of oral, nasal and pharyngeal spaces, it is to be noted that soft tissue walls formed by lips, cheeks, floor of the mouth, tongue, soft palate are the determinants of these important functional spaces. Tongue is the most agile, versatile appendage in the body. It is the largest organ of the oral cavity and has no skeletal bony base. Peat[5] emphasized the role of tongue in positioning of dento-alveloar structures. Not only the function, but also the growth, posture or function of tongue are of significance. Rakosi[6] proposed that abnormalities of either posture or function could possibly contribute to development of skeletal malocclusion. Fishman[7] also demonstrated that form and function have some direct relationship to abnormal tongue posture and movement. These findings suggest that position of tongue is related to skeletal morphology. For this, the position should be evaluated in different sagittal pattern to establish if it actuallyaffect the skeletal morphology. In 1872, Tomes hypothesized that maxillary constriction could be caused by lymphatic tissue hypertrophy of the pharynx that caused the absence of lip seal and a lower tongue position. According to the Balter's philosophy, Class II malocclusion are a consequence of backward position of a tongue, disturbing the cervical region. Thus, it is necessary to assess tongue in orthodontic diagnosis and treatment planning, as the functional, positional and structural assessment of the dentofacial pattern.

In this study, attempt has been made to compare the tongue position of subjects in skeletal Class II & Class III at rest.

II. Material & Methods

The Pre-treatment lateral cephalometric radiographs were selected from Out Patient department of the Post- graduate department of Orthodontics &Dentofacial Orthopaedics, Government Dental College & Hospital, Srinagar. The sample size for this study has been determined scientifically. Sample size determination was done using Cohen's d power table. For the proposed study the probability of type 1 error(α) was fixed at 5% and probability of type 2 error (β) at 20%. Hence, the power of the study was set at 80%. So, for the power of the study as 80% the sample size of minimum of 51 for each group was established. Based on the above calculations, the study included a total of 102 sample, 51 subjects in Class II skeletal pattern and 51 subjects in Class III skeletal pattern. The sample consisted of 51 female subjects & 51 male subjects. The level of significance was set at 0.05. Total of 102 subjects (age 14–33 years) were included. All subjects met the following **inclusion criteria:**

i) No history of orthodontic treatment.
ii) Breathing comfortably through the nose.
iii) No wound, burn or scar tissue in the neck region.
iv) No deglutition disorder.

And the following **exclusion criteria**:

i) Subjects with cleft lip and palate.
ii) Subjects with history of chronic mouth breathing, snoring and tonsillectomy.

To have standardized cephalometric radiographs, it became important that all the radiographs were taken from the same X-ray machine with the subjects in the natural head position, with teeth in maximum intercuspation and lips at repose. All the lateral cephalometric radiographs were taken by the same operator from the standardized Orthophos XG5 DS CEPH (SIRONA) on a standard Konica Minolta 8 × 10 inch film with an anode to mid subject distance of 5 feet by the same operator. Natural head position was obtained by asking the subject to look straight ahead such that the visual axis was parallel to the floor. Thyroid shield and lead apron were worn by the subject to reduce radiation exposure. All the films were exposed with 64 KVp, 8 mA and an exposure time of 9 seconds.

A sample of 102 lateral cephalograms was taken. Lateral cephalogram were traced upon an A4 size acetate paper with a 2B or 3HB hard lead pencil over well-illuminated viewing screen. The linear measurements were recorded with a measuring scale up to a precision of 0.5 mm.

After going through different studies conducted on the parameters used for assessment of antero-posterior discrepancy [8,9,10,] it was decided to segregate the radiographs into different antero-posterior skeletal patterns. Keeping in view the limitations of each parameter used individually, three parameters were used to rule out any bais of the sample segregation (table-1). In order to fall into a particular skeletal pattern, the subject had to agree with atleast two of the three parameters.

TABLE 1: Parameters for segregation into different sagittal skeletal patterns.

S.NO.	PARAMETER	NORMAL VALUES		
		Class I	Class II	Class III
1.	ANB	1-5˚	>5˚	<1˚
2.	Witt's Appraisal	0 mm (F)-1mm (M)	>1mm	<0mm
3.	β – angle	27˚ -35˚	<27˚	>35˚

Landmarks undertaken in the same are as discussed below.

- TT: Tongue tip
- Tp: Highest point on the tongue.
- Eb: Base of the epiglottis
- P: Base of tongue.
- PNS: Posterior nasal spine
- ANS: Anterior nasal spine
- Me: Menton
- Go: Gonion
- Phy: Posterior pharyngeal wall

Fig- 1

Planes and Parameters used (Fig-1):
A total of 4 parameters were undertaken in the study. They are as follows:
1. TGL, tongue length *(Eb-TT)*- Line connecting Eb& TT.
2. TGH, tongue height- Linear distance along the perpendicular bisector of the Eb-TT line to dorsum of tongue.
3. ANS-PNS-Tp- The shortest distance between the dorsum of tongue (from the point Tp) &maxillary plane (ANS-PNS).
4. Phy-P- Linear distance between base of the tongue (P) to posterior pharyngeal wall (Phy) .

III. Observations& Results

SPSS (Version 16.0) and Microsoft Excel software were used to carry out the statistical analysis of data. Data was analyzed with the help of descriptive statistics viz., mean and standard deviation and presented by bar diagrams. Student's independent t-test was employed to test the differences between male and female subjects and in between the two groups.P-value of less than 0.05 was considered statistically significant.
The results of the statistical analysis are shown in table 2 through 4.

Table 2- Mean, Standard deviation and P values for sex differences in Skeletal Class II

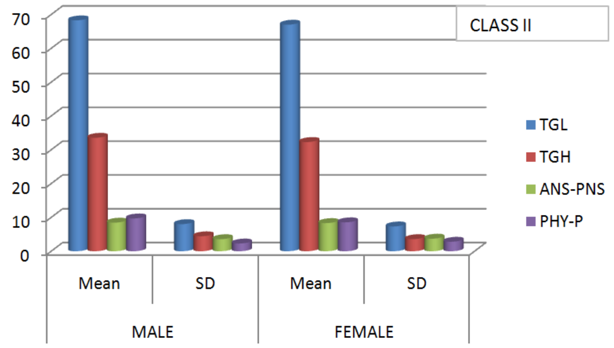
Variable	Male		Female		Total		P value for sex difference
	Mean	SD	Mean	SD	Mean	SD	
TGL(mm)	68.29	8.02	67.00	7.34	135.29	15.36	.821
TGH(mm)	33.56	4.43	32.30	3.58	65.84	8.01	.314
ANS-PNS-Tp(mm)	8.46	3.57	8.33	3.73	16.79	7.30	.761
PHY-P(mm)	9.71	2.29	8.56	2.81	18.27	5.1	.099

Within, Class II, no statistically significant was detected in any of the four parameters in between the gender.

Table 3- Mean, Standard deviation and P values for sex differences in Skeletal Class III

Variable	Male		Female		Total		P value for sex difference
	Mean	SD	Mean	SD	Mean	SD	
TGL(mm)	71.33	6.27	71.25	4.96	142.58	11.23	.897
TGH(mm)	33.56	7.16	30.21	4.56	63.77	11.72	.101
ANS-PNS-Tp(mm)	8.52	4.14	7.63	4.14	16.15	8.55	.277
PHY-P(mm)	12.00	4,17	12.25	4.87	24.25	9.04	.516

Within, Class III, no statistically significant was detected in any of the four parameters in between the gender.



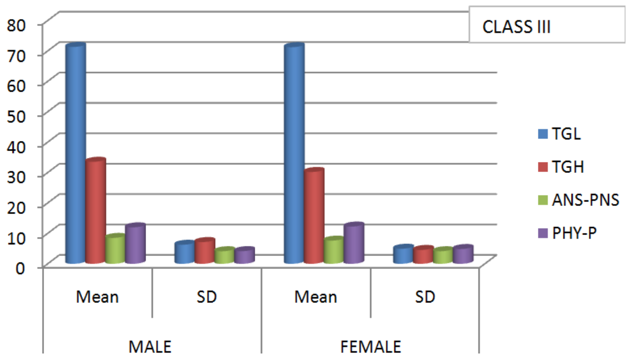
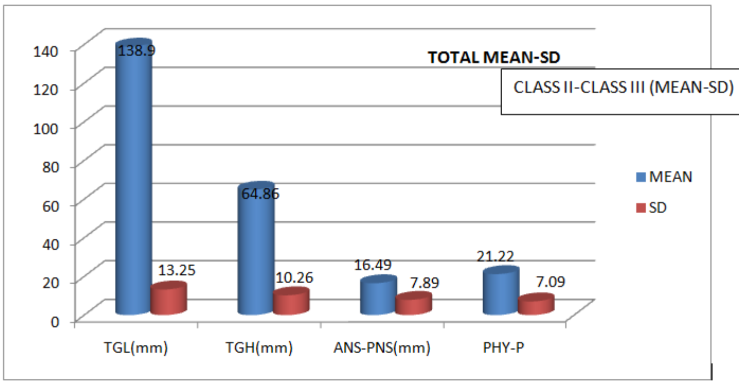
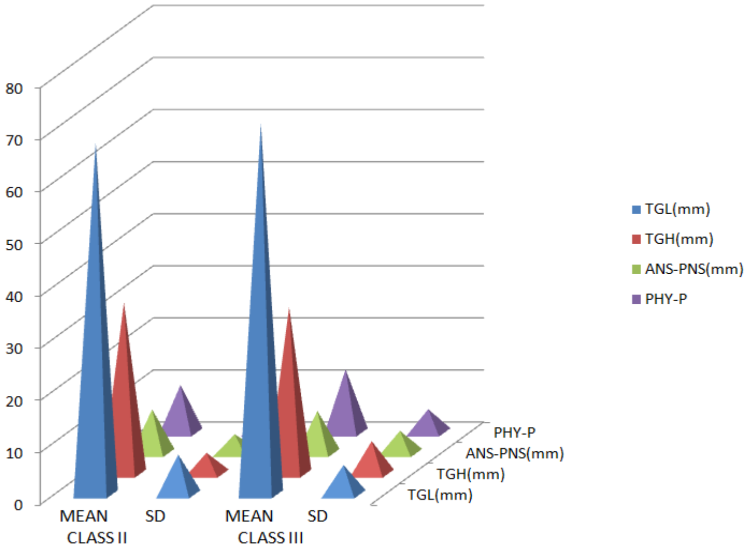


Table 4- Mean, Standard Deviation and P Values for Skeletal Class II & Skeletal Class III					
VARIABLE	Class II		Class III		P-VALUE FOR CLASS II & CLASS III
	MEAN	SD	MEAN	SD	
TGL(mm)	67.61	7.62	71.29	5.63	.007*
TGH(mm)	32.88	4.01	31.98	6.25	.365
ANS-PNS(mm) -Tp	8.39	3.62	8.10	4.27	.726
PHY-P(mm)	9.10	2.62	12.12	4.47	.000*





In Class II, Gender differences were not detected in any of the four parameters.
In Class III, Gender differences were not detected in any of the four parameters. In total group comparison considering all four parameters that were undertaken in the study, it was found that the Tongue length (TL) was significantly reduced in Class II subjects when compared to Class III subjects ($p<0.05$), the Tongue was significantly closer to pharyngeal wall Phy-P in Class II subjects when compared with Class III subjects ($p<0.005$).

IV. Discussion

Centrally located within the oral cavity, the tongue is a powerful muscular organ which has the ability to affect the position of teeth and surrounding structures. Although its attachments are principally to the mandible and the hyoid bone, the role of the tongue in positioning the dentoalveolar structures has long been acknowledged. Abnormality of either function or position can lead to change in the surrounding dentoalveolar structure and skeleton. The reasons for excluding patients with cleft lip and palate was to rule out any syndrome which might affect the skeletal anteroposterior dimensions. Subjects with normal nasal breathing and normal antero-posterior skeletal patterns were taken up for this study. With Brodbent's introduction of cephalostat in 1931[11], a new era of antero-poterior assessment began in Orthodontics. The use of lateral cephalometric radiographs to evaluate the soft tissues is somewhat limited as they provide only 2-dimensional images of the nasopharynx, which consists of complex 3-dimensional anatomical structures[12]. Linder-Aronson[13] found a high level of correlation between the results of posterior rhinoscopy and radiographic cephalometrics in the assessment of adenoid size. This observation was made also by earlier authors[14,15,16] who found that lateral skull radiographs provide a good picture of the soft tissues in all ages. Further, cephalometrics is easy to use, economical, and can provide definitive and quantitative information about the soft tissues.

The first parameter used to assess antero-posterior skeletal relationship was ANB angle. The ANB angle is considered the most commonly used cephalometric measurement for evaluation of antero-posterior jaw relationship.[8] Furthermore, Hussels and Nanda[9] reported that the vertical lengths from nasion to point B and from point A to point B are usually affected. Second, most widely used measurement to assess the antero-posterior skeletal relationship, the Wit's appraisal, was introduced to overcome problems related to the ANB angle.[10] However, the Wit's appraisal relates points A and B to the functional occlusal plane; this generates 2 major problems. First, accurate identification of the occlusal plane is not always easy or accurately reproducible,[17] especially in mixed dentition patients or patients with open bite, severe cant of the occlusal plane, multiple impactions, missing teeth, skeletal asymmetries, or steep curve of Spee. Second, any change in the angulation of the functional occlusal plane, caused by either normal development of the dentitionor orthodontic intervention, can profoundly influence the Wit's appraisal. Therefore, consecutive comparisons of the Wit's appraisal throughout orthodontic treatment might be of limited value because they also reflect changes in the occlusal plane instead of pure antero-posterior changes of the jaws. To overcome these problems, a new measurement was considered. This measurement, the Beta angle, does not depend on cranial landmarks or the functional occlusal plane. It uses 3 points located on the jaws- point A, point B and the apparent axis of the condyle 'point C'. The changes in this angle reflect only changes within the jaws. In contrast to the ANB angle, the configuration of the Beta angle gives it the advantage to remain relatively stable even when the jaws are rotated. Another advantage of the Beta angle is that it can be used in consecutive comparisons throughout orthodontic treatment because it reflects true changes of the sagittal relationship of the jaws, which might be due to growth or orthodontic or orthognathic intervention.[18] However, precisely tracing the condyle and locating its center is not always easy. For that reason, some clinicians might hesitate to use the Beta angle. To accurately use that angle, the cephalometric x-rays must be high quality and it still depends upon point A & point B which according to Holdaway[19], change the site substantially due to both treatment and growth.

Tongue dimensions were not affected by gender in Class II and Class III subjects. These findings are in agreement with those reported in the literature,[20,21,22,23] which suggest that gender differences in the tongue dimensions are not present. In our study we found that, Tongue length was found to be significantly longer in Class III subjects when compared to Class II. Also, it was found that the tongue was placed closer to pharyngeal wall in Class II subjects when compared to Class III subjects. The relationship between tongue length and its position in relation to pharyngeal wall in skeletal Class II and Class III appears logical, because as the body of the mandible lengthens, the attachments of the genioglossus and geniohyoid muscles move forward away from the oropharynx, increasing the pharyngeal space. This could be explained as a more posterior positioning of the temporomandibular joint, requires a longer mandible to maintain a normal relationship with the maxilla, as such increasing the oropharynx and also affecting the position of tongue as well as hyoid bone. The skeletal pattern can be suggested as potential explanation for the discrepancy in the tongue length and position as a result of mandibular size and position.[20]

As such this study is not directly related to the Obstructive sleep apnoea (OSA) but considering the factors involved in the etiology and serious concerns about Obstructive sleep apnoea as well as its investigative procedures are on the rise. A narrow upper airway and other predisposing or etiological factors, such as craniofacial deformity, mandibular retrognathia or micrognathia, tongue position, muscular hypotony, sleep posture, fatty depositions in soft tissue of the upper airway, gender, and age, have been reported. Planning successful treatment for the correction of anatomic abnormalities of upper airway by surgically advancing mandible depends on extensive knowledge of pharyngeal airway space, and morphology, hyoid bone, and tongue position and the changes induced by the advancement surgery in the said structures.

V. Conclusion

In **conclusion** of this study that was undertaken, following points can be made.

- There was no significant difference in tongue dimensions among male and female subjects in Class II skeletal patterns.
- There was no significant difference in tongue dimensions among male and female subjects in Class III skeletal patterns.
- Tongue length was longer in Class III subjects when compared to Class II subjects.
- Tongue was placed closed to pharyngeal wall in Class II than in Class III subjects.

A significant positive correlation was established between the tongue position and the Class II & Class III skeletal patterns.

Although the scientifically calculated sample size of 102 was taken in the present study, further studies with a bigger sample size are warranted for future research purposes.

References

[1]. Moss ML. The functional matrix hypothesis revisited 1. *Am J OrthodDentofacOrthop.* 1997; 112:220-227.
[2]. Moss ML. The functional matrix hypothesis revisited 2. *Am J OrthodDentofacOrthop.* 1997; 112:228-236.
[3]. Moss ML. The functional matrix hypothesis revisited 3. *Am J OrthodDentofacOrthop.* 1997; 112:236-250.
[4]. Moss ML. The functional matrix hypothesis revisited 4. *Am J OrthodDentofacOrthop.* 1997; 112:251-264.
[5]. Peat JH. A cephalometric study of tongue position. Am J Orthod. 1968;54: 339–51.
[6]. Rakosi T. London: Wolf Medical Publication Limited; 1978. An atlas and manual of cephalometric radiography; pp. 96–8.
[7]. Fishman LS. Postural and dimensional changes in the tongue from rest position to occlusion. Angle Orthod. 1969;39:109–13.
[8]. Oktay H. A comparison of ANB, WITS, AF-BF, and APDI measurements. *Am J. OrthodDentofac Orthop*.1991; 99: 122–128.
[9]. Hussels W, Nanda RS. Analysis of factors affecting angle ANB. *Am J Orthod.*1984; 85:411-423.
[10]. Holdaway RA. Changes in relationship of point A and B during orthodontic treatment. *Am J Orthod.* 1956; 42:176-193.
[11]. Broadent WH. A new X-ray technique and its application to Orthodontics. *Angle Orthod.* 1931; 1:45-56.
[12]. Vig PS. Respiration, nasal airway, and orthodontics: A review of current clinical concepts and research. In: Johnston Jr. LE(ed). New Vistas in Orthodontics. Philadelphia, PA: Lea and Fibiger. 1985;76:102.
[13]. Linder-Aronson S, Woodside DG. The growth in sagittal depth of the bony nasopharynx inrealtion to some other facial variables. In McNamara JA (ed). Nasorespiratory Function and Craniofacial Growth. Ann Arbor, MI, University of Michigan Press. 1979, 27-40.
[14]. Grandy CD. Roentgenographic demonstration of adenoids. *Am J RadiolRadiother.* 1925;14-114:38.
[15]. Weitz HL. Roentgenography of adenoids. *Radiology.*1946;47-78.
[16]. Zwiefach E. The radiographic examination of adenoid mass and upper air passages. *J Laryngol Otol.* 1954;68:758-764.
[17]. Rushton R, Cohen AM, Linney FD. The relationship and reproducibility of angle ANB and the Wit's appraisal. *Br J Orthod.* 1991; 18:225-31.
[18]. Solow B, Siersbæk-Nielsen S, Greve E. Airway adequacy, head posture, and craniofacial morphology. *Am J Orthod*. 1984; 86:214–223.
[19]. Holdaway RA. Adjusting A-N-B angles to reflect the effect of maxillary position. *Angle Orthod.* 1981;51:700-711.
[20]. Dunn GF, Green LJ, Cunat JJ. Relationships between variation of mandibular morphology & variation of nasopharyngeal airway size in monozygotic twins. *Angle Orthod*.1973; 43:129–135.
[21]. Martin, Muelas. Nasopharyngeal cephalometric study of ideal occlusion. *Am J OrthodDentofacOrthop*. 2006:436 -436.
[22]. Zong Z, Tang Z. A comparison study of upper airway in different skeletal craniofacial patterns in nonsnoring Chinese children. *Angle Orthod.* 2010; 80:267-274.
[23]. Kumar A, Kumar A, Subbiah S, Senkutvan RS. Pharyngeal airway dimensions in different types of malocclusion. *Int Jour of Dental Sciences & Research.* 2014; 2:7-11.
[24]. Albert H. A radiographic study of tongue posture at rest & during phonation as in Class III malocclusion. Angle Orthod. 1988;48:10-22.