Assessment of tongue space area in a sample of Iraqi adults with class I dental and skeletal pattern

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ABSTRACT

Background: Lateral cephalometric radiography is commonly used as a standard tool in orthodontic assessment and treatment planning. This study aimed to determine the tongue and surrounding space area in a sample of Iraqi adults with class I dental and skeletal pattern.

Materials and methods: The study included thirty healthy subjects (15 males and 15 females) with an age ranged between 23-34 years and class I dental and skeletal pattern with no history of any sleep related disorders. The assessed cephalometric measurement included length and height of the tongue and position of hyoid bone from cervical line. Descriptive statistics were obtained for the data. Genders difference was evaluated by independent sample t-test.

Results: There were significantly higher values in males as compared to females in most of the measurements.

Conclusions: The study provides preliminary details of tongue space area assessment in normal class I profile subjects.

Keywords: Tongue space, lateral cephalometrics. (J Bagh Coll Dentistry 2015; 27(1):117-120).

INTRODUCTION

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 [1] emphasized the role of tongue in positioning the dento-alveolar structure. The tongue forms a major part of upper airway and compromise of both extrinsic and intrinsic muscles [2]. Tongue form and size influence the shape and dimensions of airway between palate and tongue surface [3]. Cepholometry enables the analysis of dental and skeletal anomalies as well as soft tissue structures and forms [4].

Many studies in the past have assessed measurements of airway space and tongue size by means of cephalometry in subjects with obstructive sleep apnea in various malocclusions [5,6]. This study was aimed to collect measurements of tongue and surrounding area representing position of hyoid bone in relation with tongue and cervical vertebra using lateral cephalometric analysis in a sample of Iraqi adults with class I dental and skeletal pattern.

MATERIALS AND METHODS

Fifty students from College of Dentistry, Baghdad University accepted to enroll in this study. They were subjected to clinical examination to fulfill the inclusion criteria of this study. The inclusion criteria included having full permanent dentition regardless the third molars and class I dental and skeletal relation as indicated by Angles' classification and two finger method of Foster with no history of any related airway disorders like obstructive apnea.

Thirty students only fulfilled the inclusion criteria and proceeded to standardized digital true lateral cephalometric X-ray using Planmeca Proline cc 2002 with dimax 3 software. The subjects were positioned within cephalostat with Frankfort plane horizontal and teeth in maximum intercuspation and instructed not to swallow during exposure. The digital images were analyzed using AutoCAD 2007 software. Firstly, the magnification was corrected using the rule of the nasal rod, then the cephalometric points, planes were determined and the linear measurements were obtained.

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Cephalometric Landmarks [14]

1. **Point TT:** (Tip of the tongue): The most anterior point of the tip of tongue.
2. **Point S:** Superior part of the tongue the most superior point on the dorsum of the tongue.
3. **Point V:** (Vallecula): Junction of base of tongue with epiglottis.
4. **Point AH:** The most anterior and superior point on the body of hyoid bone.
5. **Point Po:** The highest point on the superior surface of soft tissue of the external auditory meatus.
6. **Point Or:** The lowest point on the average left and right borders of the bony orbit.
7. **Point A:** The deepest point on the concave outline of the upper labial alveolar process on the frontonasal suture.
8. **Point B:** The deepest point on the bony curvature between the crest of alveolus and the pogonion point.
9. **Point N:** Anterior point on the frontonasal suture.

Cephalometric planes:

1. **Frankfort plane (FP):** The line runs from orbitale to porion ,it represent the ideal horizontal position of head when patient stand erect.

2. **Cervical line (CL):** The line overlying the anterior surface of second and third cervical vertebrae

Linear measurements

1. **V-TT:** Distance from tip of tongue to base of tongue and represent tongue length.
2. **TH:** Tongue height from S point perpendicular to VTT.
3. **V-FP:** The line from V perpendicular to FP.
4. **V-CL:** The line form V to CL parallel to FP
5. **AH-FP:** Line from tip of anterior of hyoid to and perpendicular on Frankfort plane.
6. **AH-CL:** Line from tip of anterior of hyoid to cervical line parallel to Frankfort plane.
7. **Tongue area:** The area formed by the line encircling the tongue boundaries passing through tip of the tongue, S point and V point.

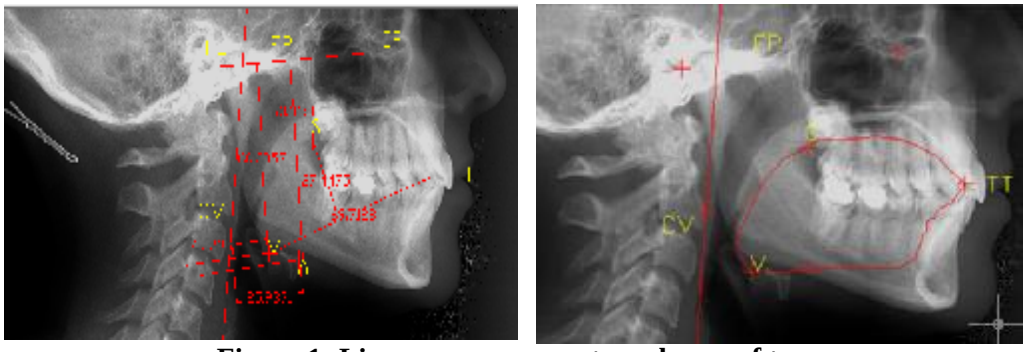

Figure 1: Linear measurements and area of tongue.

Statistical Analyses

All the data of the sample were subjected to computerized statistical analysis using SPSS version 19 computer program. The statistical analysis included:

1. **Descriptive Statistics:** Means and standard deviations.
2. **Inferential Statistics:** Independent-samples t-test for the comparison between both genders

In the statistical evaluation, the following levels of significance are used:

Non-significant	NS	$P > 0.05$
Significant	S	$0.05 \geq P > 0.01$
Highly significant	HS	$P \leq 0.01$

RESULTS

As indicated in table 1, the results showed that the vertical and horizontal measurements of vallecula and hyoid bone and tongue area were higher in males than in females with a highly significant difference.

Table 1: Descriptive statistics and genders difference for the measured variables

Variables	Genders	Descriptive statistics					Genders difference (d.f.=28)		
		N	Mean	S.D.	Min.	Max.	Mean Difference	t-test	p-value
V-TT (mm.)	Males	15	76.08	4	69.35	82.9	7.71	7.02	0.000 (HS)
	Females	15	68.38	1.44	66.2	70.7			
TH (mm.)	Males	15	33.46	1.84	30.52	36.5	4.53	7.77	0.000 (HS)
	Females	15	28.93	1.31	26.67	31			
V-FP (mm.)	Males	15	80.52	4.05	73.8	87.9	10.97	6.74	0.000 (HS)
	Females	15	69.55	4.83	60.5	77.7			
V-CL (mm.)	Males	15	19.98	2.45	15.23	23.8	3.53	4.80	0.000 (HS)
	Females	15	16.45	1.45	14.12	18.6			
AH-FP (mm.)	Males	15	87.32	4.29	81.45	94.6	14.79	8.35	0.000 (HS)
	Females	15	72.53	5.35	63.3	80.7			
AH-CL (mm.)	Males	15	34.14	2.78	27.2	38.1	6.47	7.05	0.000 (HS)
	Females	15	27.67	2.21	24.21	30.9			
T-AREA (mm^2.)	Males	15	2551.67	77.31	2398	2672	383.07	13.78	0.000 (HS)
	Females	15	2168.60	74.89	1990	2293			

DISCUSSION

The lateral cephalogram is a two dimensional image showing the sagittal aspect of head and neck region and usually used for orthodontic treatment. Maltais *et al* [8] had opined that the use of cephalometric radiographs to assess the upper airway anatomy is helpful because it is simpler than other methods for measuring airway patency.

Parkkinen *et al* [12] confirmed in their study that lateral cephalogram is a valid method for measuring dimensions of nasopharangeal and retropalatal region. The present study included a group of Iraqi subjects with clinically normal dental and skeletal relations, any reported abnormality of upper airway were excluded from this study. Similar studies have been conducted on normal adults in various populations [7,10].

The length of the tongue sagittally, height of the tongue measured from the highest point on the dorsam of the tongue and perpendicularly on VTT line ,vertical and horizontal distance of vallecula and hyoid bone from cervical line horizontally and Frankfort line vertically were larger in male than in females. The results of the study by Samman *et al* [7] to evaluate normative data in Hong Kong Chinese subjects were correlated with this study.

The present study showed that the length of tongue and tongue area in normal males subjects were comparatively of larger dimensions with respect to normal Indian males Guttal *et al* [10] and smaller dimensions with respect to normal Hong Kong Chinese males Samman *et al* [7]. In the study of Battagel *et al* [9] the tongue area in normal Caucasian males subjects was 4120mm^2.

However in the present study the tongue area among normal Iraqi male subjects was 2551mm^2, implying that the tongue area in normal Iraqi males was comparatively of smaller dimension with respect to normal Caucasian males and normal Hong Kong Chinese males. In the study by Tsai *et al* [11] on normal Taiwanese subjects, the position of hyoid bone in horizontal plane correlate with the results of the present study. The cephalometric norms of different ethnic and racial groups established in various studies. Most investigators have concluded that there are significant differences between ethnic and racial groups, and cephalometric standards have been developed for specific ethnic and racial groups [13].

In this study, the vertical and horizontal distances of vallecula and hyoid bone were larger in male than in females so that they are more inferiorly and anteriorly positioned in men. The present study also signifies the importance of the use of cephalometry for the assessment of oral and surrounding structures. The cephalometric measurements in this study group can be used as normative data for future studies. Further correlation can be drawn with studies comparing tongue and surrounding space dimensions in normal individuals and in subjects with sleep related disorders.

Table 2: Normative data of different studies

Variables	Genders	Present study	Guttal *et al*	Samman *et al*	Battagel *et al*
V-TT (mm.)	**Males**	76.08	71.15	72.0	-
	Females	68.38	66.86	64.8	-
S-TT (mm.)	**Males**	33.46	32.4	36.9	-
	Females	28.93	27.8	32.9	-
V-FP (mm.)	**Males**	80.52	77.6	91.2	-
	Females	69.55	68.4	78.9	-
V-CL (mm.)	**Males**	19.98	15.8	23.0	-
	Females	16.45	11.8	20.4	-
AH-FP (mm.)	**Males**	87.32	79.3	92.4	-
	Females	72.53	70.5	78.5	-
AH-CL (mm.)	**Males**	34.14	30.0	36.4	-
	Females	27.67	24.4	31.2	-
T-AREA (mm^2.)	**Males**	2551.67	2479	2746	4120
	Females	2168.60	2191	2259	-

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الخلاصة

الخلفية: التصوير الشعاعي بواسطة صورة الاشعة الراسية الجانبية يعتبر من الادوات الاساسية المعروفة التي تستخدم في التحليلات المستخدمة في علم تقويم الاسنان و وضع الخطط العلاجية فيه. ان هذة الدراسة تهدف الى الحصول على معلومات راسية (منقطة الرأس) عن اللسان والمنطقة المحيطة باللسان في الاشخاص البالغين الطبيعيين .

المواد والطريقة : الدراسة تتضمن ثلاثين صورة اشعة راسية رقمية (15 ذكور و15 اناث) لاشخاص اصحاء بالغين ومتوسط عمري يتراوح من 23 – 34 سنة ويمتلكون التصنيف الاول للمظهر الجانبي مع عدم وجود اي تاريخ لاي مشاكل تنفسية اثناء النوم .

النتائج: وجود دلائل احصائية بين الذكور والاناث بالنسبة لجميع القياسات .

الاستنتاج: ان هذة الدراسة قدمت لنا معلومات جيدة عن وضعية اللسان والاجزاء المحيطة به في الاشخاص البالغين ذو التصنيف الاول للمظهر الجانبي .