مجلة جامعة تشرين للبحوث والدراسات العلمية _ سلسلة العلوم الصحية المجلد (37) العدد (2) 2015
Tishreen University Journal for Research and Scientific Studies - Health Sciences Series Vol. (37) No. (2) 2015

Relationship of the Nostrils Morphology with Facial Growth Type In Adults (CBCT Scan Study).

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(Received 9 / 3 / 2015. Accepted 2 / 4 / 2015)

□ ABSTRACT □

Keeping the nasal morphology balanced with the other parts of the face and in harmony with the type of the facial growth constitutes one of the most challenging goals that have to be carefully considered in planning the Orthodontics and Dentofacial Orthopedic treatment. Nostrils are part of the soft tissue of the nasal respiratory system, which affect growth development of the craniofacial complex.

Aim: to investigate the relationship of the Nostrils Morphology with Facial Growth Type in adults using Cone-Beam Computed Tomography (CBCT) scan.

Materials and methods: 23 adult subjects (8 males, 15 females), were chosen from pretreatment patients undergoing orthodontic evaluation at the Department of Orthodontics and Dentofacial Orthopedics at Tishreen University and were ordinarily undergoing CBCT scan for non-orthodontics and for otolaryngology purpose. Cephalometric measurements determining facial growth type were performed according to Jarabak's analysis. *Pearson's Correlation Coefficient* was calculated to investigate the relationship between the CBCT nostrils measurements and Cephalometric measurements determining facial growth type.

Results: The studied CBCT nostrils measurements have differences with statistical significance between the two genders. CBCT nostrils measurements have relationship with facial type growth.

Conclusions Nostrils morphology appears to vary with the type of facial growth.

Keywords: nostrils morphology, Facial growth cephalometric evaluating according to Jarabak, Nostrils soft-tissue CBCT.

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Tishreen University Journal for Research and Scientific Studies - Health Sciences Series Vol. (37) No. (2) 2015

علاقة الصفات الشكلية لمنخري الأنف مع نموذج النمو الوجهي لدى البالغين (دراسة بواسطة الطبقي المحوري المخروطي)

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(تاريخ الإيداع 9 / 3 / 2015. قُبِل للنشر في 2 / 4 /2015)

☐ ملخّص ☐

يعتبر تحقيق توازن صفات شكلية مع بقية العناصر المكونة للوجه وإبقائها منسجمة مع نموذج النمو الوجهي تحدياً من أكثر التحديات صعوبة والتي يجب أن يتم أخذها بعين الإعتبار بحذر بالغ أثناء التخطيط للمعالجة في تقويم الأسنان والفكين، حيث يعد منخري الأنف جزء من النسيج الرخو المكون للجهاز التنفسي الأنفي الذي يؤثر على نمو وتطور المركب القحفي الوجهي

هدف البحث: تحري وجود علاقة بين الصفات الشكلية لمنخري الأنف وبين نموذج النمو الوجهي وذلك لدى أفراد من البالغين باستخدام التصوير الطبقي المخروطي.

مواد وطرق البحث: بلغ أفراد العينة 23 بالغاً (8 ذكور،15 أنثى) من مراجعي قسم تقويم الأسنان والفكين بكلية طب الأسنان بجامعة تشرين ولم يخضعوا لمعالجة تقويمية سابقة حيث تم انتقاؤهم من مرضى كانوا تلقائياً بصدد إجراء تصوير طبقي محوري مخروطي لأسباب لا تتعلق بمشاكل تقويمية أو بأمراض الأنف والأذن والحنجرة، تم إجراء دراسة سيفالومترية للنمو الوجهي وفق تحليل جاراباك، ومن ثم تحليل معامل ارتباط بيرسون لدراسة العلاقة بين قياسات منخري الأنف المجراة على صور الطبقي المحوري المخروطي مع القياسات السيفالومترية المحددة لنموذج النمو الوجهي.

النتائج: قياسات منخري الأنف المجراة على صور الطبقي المحوري المخروطي تمتلك فروقات ذات دلالة إحصائية بين الجنسين، قياسات منخري الأنف المجراة على صور الطبقي المحوري المخروطي يمتلكان علاقة ذات دلالة إحصائية مع نموذج النمو الوجهي.

الخلاصة: يبدو أن الصفات الشكلية لمنخري الأنف تتغير بتغير نوع نموذج النمو الوجهي.

الكلمات المفتاحية: الصفات الشكلية لمنخري الأنف، نمو وجهي محدد حسب جاراباك، تصوير طبقي محوري مخروطي للنسج الرخوة للمنخرين.

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Introduction:

Balanced facial morphology can be determined by the relative size and position of each part of the face (forehead, nose, upper jaw, lower jaw and chin). Each has a relation and effect on the others. Keeping the nasal morphology balanced with the other parts of the face and in harmony with the type of the facial growth constitutes one of the most challenging goals that have to be carefully considered in planning of the Orthodontics and Dentofacial Orthopedic treatment. Numerous researches studied the nasal respiratory function and its relationship to growth development of the craniofacial structures [1-6]. It has classically been maintained that because of large adenoids, nasal breathing is (partially) obstructed leading to mouth breathing and the stereotype of the adenoid face (patients with the long-face syndrome) which considered as an evidence of the strong correlation between the function and facial growth process.[1, 3, 7-10]. Malhotra (2012) noted that mouth-breathing patient could have typical pinched nose appearance, with small nostrils [11].

In contrary to Moss (1965), findings of Björk and Skeiller (1983) did not support the view that the matrix is a dominating factor and that bone formation is secondary in mandibular growth (which it is a part of the facial growth), but point to considerable independence in development of the two tissue systems [12]. Nostrils are part of the soft tissue of the nasal respiratory system, nasal respiratory function and its relationship to growth development of the craniofacial structures has been a subject of interest and controversy for over 100 years [13], but we still do not have a clear idea about the relationship of the morphology of the nostrils soft issue with facial growth type.

Study Objectives

The aim of this study is to investigate the relationship of the Nostrils Morphology with Facial Growth Type in adults and the (including the gender related differences) using CBCT scan.

MATERIALS AND METHODS

-Subjects.

Sample's subjects were selected from patients who were ordinary undergoing CBCT scan for non-orthodontic nor for otolaryngology purpose.

The criteria for selecting the subjects were taken as follows:

1) No history of speech-language pathology and/or orthodontic and/or orthopedic treatment
2) patient with tongue thrust, upper respiratory tract infections, mouth breathing, and snoring were excluded.
3) No history of trauma to the dento-facial structures.
4) No Otolaryngology history of trauma
5) Each subject must have fully erupted permanent dentition up to second molar tooth.
6) No supernumerary tooth / supplementary tooth / missing tooth / impacted tooth.
7) Exclusion criteria were subjects with congenital anomalies/ evident signs of neurological impairment and/or syndromes and/or dentoskeletal asymmetries and/or craniofacial malformation.

In 1986, Farkas [14] reported that the angles of the nose essentially stop growing at the age of 12 in women and at age 14 or 15 in men, and the size and shape of the external nose is less likely change after maturity. Thus, present study selected adult subjects aged between 19 and 26 years old. To exclude patient upper respiratory tract infections, mouth breathing, and snoring, patients were examined by the same otolaryngologist.

Sample estimation

To determine the minimum sample size to be statistically significant, a pilot study was realized on 20 subject (who were selected according to the criteria of selecting this study`s sample). It has been found that descriptive statistics results follow the normal distribution; therefore, determining the minimum sample size to be statistically significant was according to the following formula:

$$n = \frac{Z^2.\sigma^2}{(e)^2}$$

(N): is the sample size ;.(z): is the value corresponding to a confidence level, estimated at 99% (Z = 2.58) (i.e. significance level is 0.019), (σ): highest Standard Deviation value within the all variables (σ = 7.25)

(e): Margin of error (maximum acceptable error in mean estimate) (e=5)

Thus:

$$n = \frac{(2.58)^2(7.95)^2}{5^2} \approx 16.7$$

According to this pilot study, we determined that to get an exact estimating about the mean of patients results, and the error in his estimate does not exceed 5 of the mean, with a significance level of 99% requires a sample size (n) of 16.7 patients as minimum, whereas sample size of this study was n=23.

The size of this study's sample was 23 Caucasian patients (8 males, 15 females) from 19 to 26 years of age, (mean age of 24.1 years; Males average age: 20.4; Females average age: 24.2).

- CBCT study:

Data were obtained using a 3D cone-beam volume scanner (i-CAT Cone Beam 3-D Imaging System, PA.). The following settings were used:

- 30 cm field of view (in the coronal plane).
- 120 kV.
- 47mA.
- Exposure time 30 s.
- slice thickness 0.5 mm.

In the current study, hard-tissue reference planes were established, as Metzger (2013) recommended [15], first on each CBCT image showing the underlying skeletal structures. The midsagittal plane ran through nasion-anterior nasal spine-basion, the coronal plane passed through the most posterior and superior point, of the condylar head, and the axial plane passed through Frankfort horizontal plane.

According to Metzger (2013) [14], the Nostrils soft-tissue 3D view of the CBCT data was created by adjusting the threshold and Hounsfield units to the closest soft-tissue segmentation amount, and CBCT measurements were performed using software measurement tools, such as landmarking (soft-tissue landmarks) and calipers (distance and angular measurements). Linear CBCT digital measurements were accurate to the nearest 0.01 mm, Angular CBCT digital measurements were accurate to the nearest 0.01 degree.

CBCT nostrils landmarks:

Prn: (Pronasale) the most prominent point on the nasal tip. [14 -18].

Al: (Alare) the point where the nasal blade (ala nasi) extends farthest. (Al r: on right side, Al l: on the left side). [14 -18].

Al m: middle point of Al r - Al l [18].

Ac: alar curvature point. (Ac r: on right side, Ac l: on the left side). [17, 18].

Stn: (Superior point of the nostril axis) highest point of the nostril. (Stn r: on right side, Stn l: on the left side). [17, 18].

Itn: (Inferior point of the nostril axis) the point at the lower limit of each alar base. (Itn r: on right side, Itn l: on the left side). [17, 18].

CBCT nostrils measurements (from Farkas 1986 [14]) are shown in table 1:

Table 1 CBCT nostrils measurements (from Farkas 1986 [14]):

	Measurement	Unit
Stn r-Stn l	Superior width of the nostrils	mm
Al r-Al l	Nasal width	mm
Itn r- Itn l	Inferior width of the nostrils	mm
Ac r- Ac l	Alar base width	mm
Stnr-Itn r	Right length of the nostril	mm
Stn l –Itn l	Left length of the nostril	mm
Prn –Al m (mm)	Nasal tip protrusion	mm
Al r-prn-Ali	Alar slope angle	deg

Used CBCT nostrils soft-tissue landmarks and measurements are illustrated in the fig 1:

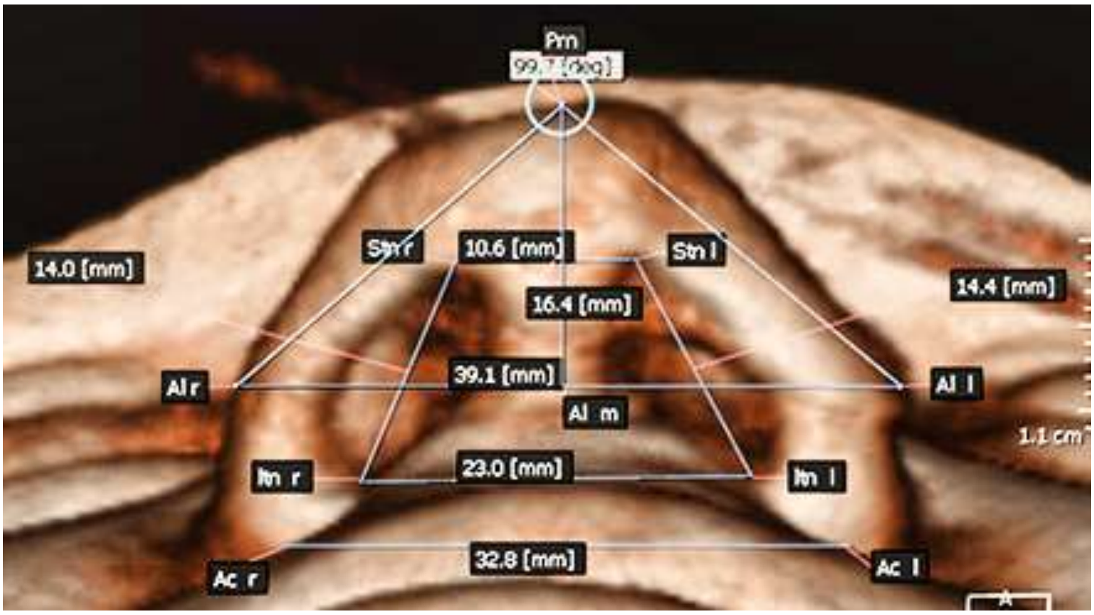

Figure 1 CBCT nostrils soft-tissue landmarks and measurements.

-lateral cephalometric analysis:

Since 2-dimensional (2D) images produced from cone-beam computed tomography (CBCT) images could substitute for traditional cephalograms [19], in this study, lateral cephalometric analysis was obtained by Kumar method (2008) using 2-dimensional images produced from cone-beam computed tomography, which were achieved in centric occlusion [20].

Facial growth was evaluated on the lateral cephalograms according to Jarabak analysis [21-23], Anterior Facial Height (N-Me), Posterior Facial Height (S-Go), Height Ratio (FHR) of Jarabak, Saddle angle (S), Articular angle (AR), Gonial angle (GO), Upper Gonial angle (GO1), Lower Gonial angle (GO2) and Jarabak sumangle (SA), were determined and calculated according to Jarabak's analysis [21-23]. Cephalometrics points and measurements that have been used in this investigation according to Jarabak analysis [21-23] showed in fig 2.

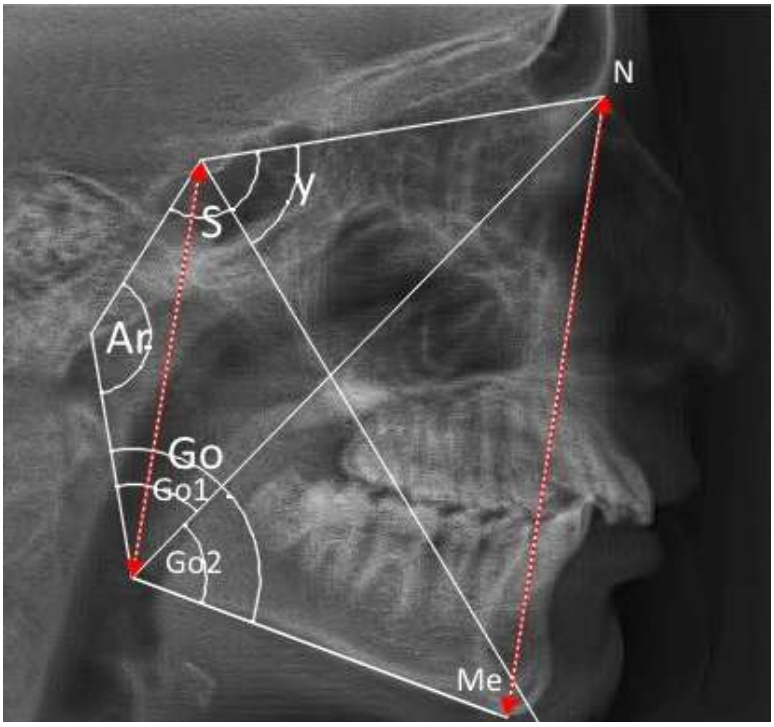

Figure 2 Cephalometrics points and measurements that have been used in this investigation according to Jarabak analysis [21-23].

Cephalometric measurements were digitally performed by the same author using software measurement tools, such as landmarking and calipers (distance and angular measurements). Linear CBCT digital measurements accurate to the nearest 0.01 mm. whereas angular measurements were accurate to the nearest 0.01 degrees.

− *Error of method:*

All cephalometric and CBCT measurements were repeated twice with a month interval, by the same calibrated investigator using the same workstation, the initial measurements and the repeated measurements were compared by using a paired t-test at $\alpha = 0.05$ to check any systematic error. The t-test did not show any statistical significance.

− *Statistical method:*

Using Microsoft Excel of Microsoft office 2013, Pearson's Correlation Coefficient was calculated to investigate the strength of a linear association of each of the **Superior width of the nostrils, Nasal width, Inferior width of the nostrils**, **Alar base width**, **Right length of the nostril**, **Left length of the nostril, Nasal tip protrusion**, and **Alar slope angle** with each of Anterior Facial Height, Posterior Facial Height, Height Ratio (FHR) of Jarabak, Saddle angle (S), Articular angle (AR), Gonial angle (GO), Upper Gonial angle (GO1), Lower Gonial angle (GO2) and Jarabak sumangle (SA)**.**

RESULTS

Descriptive statistics for CBCT nostrils measurements are presented in table 2.

Table 2 Descriptive statistics for CBCT nostrils measurements

	Mean	Standard Error	Standard Deviation	Sample Variance	Minimum	Maximum	Count
Stn r-Stn l	7.31	0.38	1.83	3.34	4.97	11.2	23
Al r-Al l	32.15	0.87	4.16	17.28	24.7	44.5	23
ltn r-ltn l	21.33	0.81	3.87	15.01	12.8	29.4	23
Ac r-Ac l	29.03	0.81	3.9	15.19	23.9	40.8	23
Stn r-ltn r	13.86	0.48	2.3	5.28	10.3	19.9	23
Stn l-ltn l	12.99	0.36	1.74	3.02	9.1	17	23
Prn-Al m	14.93	0.44	2.1	4.4	11.6	18.3	23
al r-prn-al l	94.53	1.37	6.55	42.89	81.8	108.7	23

Descriptive statistics for CBCT nostrils measurements of male subjects are presented in table 3.

Table 3 Descriptive statistics for CBCT nostrils measurements of male subjects.

	Mean	Standard Error	Standard Deviation	Sample Variance	Minimum	Maximum	Sum	Count
Stn r-Stn l	8.36	0.79	2.23	4.98	5.00	11.20	66.91	8
Al r-Al l	34.76	1.67	4.73	22.36	30.32	44.50	278.09	8
ltn r-ltn l	23.97	1.29	3.65	13.30	19.30	29.40	191.74	8
Ac r-Ac l	32.05	1.52	4.29	18.40	28.20	40.80	256.41	8
Stn r-ltn r	14.70	0.67	1.89	3.59	12.52	17.16	117.58	8
Stn l-ltn l	13.91	0.65	1.84	3.40	11.50	17.00	111.24	8
Prn-Al m	16.08	0.73	2.08	4.32	13.00	18.30	128.64	8
al r-prn-al l	94.63	2.54	7.18	51.61	81.80	102.40	757.00	8.

Descriptive statistics for CBCT nostrils measurements of female subjects are presented in table 4.

Table 4 Descriptive statistics for CBCT nostrils measurements of female subjects.

	Mean	Standard Error	Standard Deviation	Sample Variance	Minimum	Maximum	Sum	Count
Stn r-Stn l	6.75	0.34	1.34	1.78	4.97	9.10	101.26	15
Al r-Al l	30.76	0.82	3.16	9.99	24.70	37.30	461.35	15
ltn r-ltn l	19.93	0.85	3.29	10.85	12.80	25.80	298.92	15
Ac r-Ac l	27.42	0.67	2.58	6.67	23.90	33.20	411.30	15
Stn r-ltn r	13.42	0.63	2.43	5.90	10.30	19.90	201.25	15
Stn l-ltn l	12.50	0.39	1.52	2.32	9.10	15.00	187.54	15
Prn-Al m	14.31	0.49	1.89	3.59	11.60	17.40	214.65	15
al r-prn-al l	94.49	1.67	6.45	41.59	84.80	108.70	1417.30	15

CBCT nostrils measurements were compared between males and females using a t-Test: Two-Sample Assuming Unequal Variances at $\alpha = 0.05$ showed statistical significance between the two genders only for Right length of the nostril (Stnr-Itn r), Left length of the nostril (Stn l –Itn l), Nasal tip protrusion (Prn –Al m) and Alar slope angle (Al r-prn-Ali). P value of the t-Test are showed in table 5.

Table 5 P value of t-Test for comparing CBCT nostrils measurements between males and females.

	Stn r-Stn l	Al r-Al l	Itn r- Itn l	Ac r- Ac l	Stnr-Itn r	Stn l –Itn l	Prn –Al m	Al r-prn-Ali
P value at α=0.05.	0.04	0.02	0.01	0.003	0.21	0.24	0.06	0.96

Descriptive statistics for cephalometric measurements estimated facial growth type according to Jarabak (both genders, male, female) are shown in table 6.

Table 6 Descriptive statistics for cephalometric measurements estimated facial growth type according to Jarabak (both genders, male, female).

		S	*Ar*	*GO1*	*Go2*	*Go*	*SA*	*S-Go*	*N-Me*	*SA*	*Y*
Mean	♂&♀	125.85	142.71	51.71	72.96	124.67	393.23	70.53	110.39	66.11	68.47
Standard Error		1.04	1.66	1.12	1.07	1.51	1.27	1.36	1.27	0.98	0.89
Standard Deviation		5.01	7.95	5.36	5.15	7.22	6.09	6.50	6.09	4.68	4.26
Sample Variance		25.08	63.27	28.70	26.55	52.17	37.06	42.31	37.09	21.93	18.13
Count		23	23	23	23	23	23	23	23	23	23
Mean	♂	125.70	140.81	52.31	71.13	123.43	389.93	74.68	114.81	68.61	66.06
Standard Error		0.74	1.90	1.60	0.88	1.90	1.32	2.58	2.40	1.16	1.18
Standard Deviation		2.09	5.37	4.54	2.50	5.39	3.74	7.31	6.78	3.28	3.34
Sample Variance		4.38	28.83	20.59	6.23	29.03	13.98	53.37	46.01	10.75	11.16
Count		8	8	8	8	8	8	8	8	8	8
Mean	♀	125.94	143.73	51.39	73.94	125.33	394.99	68.32	108.03	64.77	69.75
Standard Error		1.57	2.34	1.52	1.54	2.10	1.67	1.28	1.10	1.25	1.09
Standard Deviation		6.10	9.05	5.87	5.97	8.13	6.46	4.97	4.26	4.86	4.23
Sample Variance		37.20	81.84	34.49	35.65	66.13	41.68	24.72	18.14	23.62	17.85
Count		15	15	15	15	15	15	15	15	15	15

Results of Pearson's Correlation test between CBCT nostrils measurements and all cephalometric measurements that have been used in this investigation with purpose of determining facial growth pattern (according to Jarabak's analysis) within all subjects of the sample (regardless of gender) are presented in table 7.

Table 7 Pearson's Correlation test between CBCT nostrils measurements and the cephalometric measurements determining facial growth type (according to Jarabak's analysis) within all subjects of the sample (regardless of gender).

	S	*Ar*	*GO1*	*Go2*	*Go*	*AS*	*S-Go*	*N-Me*	*Jarabak*	*Y*
Stn r-Stn l	0.07 ▼	-0.11 ▼	-0.01 ▼	-0.44 ▼	-0.32 ▼	-0.47 ▼	0.44▲	0.38▲	0.42▲	-0.33 ▼
Al r-Al l	-0.04 ▼	-0.44 ▼	0.38▲	-0.34 ▼	0.04▲	-0.56 ▼▼	0.41▲	0.27▲	0.49▲	-0.73 ▼▼
ltn r-ltn l	0.11▲	-0.33	0.30▲	-0.27 ▼	0.03▲	-0.30 ▼	0.19▲	0.27▲	0.17▲	-0.47 ▼
Ac r-Ac l	0.1 ▲	-0.41	0.29▲	-0.25	0.03▲	-0.42	0.35▲	0.30▲	0.35▲	-0.59
Stn r-ltn r	-0.43 ▼	0.14▲	-0.13 ▼	0.05▲	-0.06 ▼	-0.24 ▼	0.47▲	0.58▲▲	0.31▲	-0.27 ▼
Stn l-ltn l	-0.39	0.01▲	0.04▲	0.01▲	0.04▲	-0.25	0.30▲	0.62	0.27▲	-0.40
Prn-Al m	-0.14	-0.32	0.37▲	0.06▲	0.32▲	-0.15	0.19▲	0.47▲	0.13▲	-0.39
al r-prn-al l	0.14▲	-0.09 ▼	-0.03 ▼	-0.52 ▼▼	-0.40 ▼	-0.47 ▼	0.21▲	-0.28 ▼	0.41▲	-0.34 ▼

▲: Positive weak strength of correlation, ▲▲: Positive Moderate strength of correlation. ▼: Negative weak strength of correlation, ▼▼: Negative Moderate strength of correlation.

Results of Pearson's Correlation test between CBCT nostrils measurements and all cephalometric measurements that have been used in this investigation with purpose of determining facial growth pattern (according to Jarabak's analysis) within male subjects of the sample are presented in table 8.

Table 8 Pearson's Correlation test between CBCT nostrils measurements and the cephalometric measurements determining facial growth type (according to Jarabak's analysis) within male subjects of the sample.

	S	Ar	GO1	Go2	Go	SA	S-Go	N-Me	Jarabak	Y
Stn r-Stn l	-0.61 ▼▼	0.25▲	0.00 **no corr.**	0.24▲	0.11▲	0.19▲	0.13▲	0.47▲	-0.28▼	-0.03 ▼
Al r-Al l	-0.35 ▼	-0.35 ▼	0.19▲	-0.19 ▼	0.07▲	-0.59 ▼▼	0.25▲	0.08▲	0.57 ▲▲	-0.82 ▼▼▼
ltn r-ltn l	-0.21 ▼	-0.21 ▼	0.12▲	-0.27 ▼	-0.02 ▼	-0.45 ▼	0.21▲	-0.03 ▼	0.29▲	-0.72 ▼▼
Ac r-Ac l	-0.25 ▼	-0.35 ▼	0.18▲	-0.24 ▼	0.04	-0.58 ▼▼	0.14▲	-0.10 ▼	0.52 ▲▲	-0.82 ▼▼▼
Stn r-ltn r	-0.33 ▼	0.32▲	-0.23 ▼	0.37▲	-0.02 ▼	0.24▲	-0.04 ▼	0.60 ▲▲	-0.14 ▼	0.29 ▼
Stn l-ltn l	-0.43 ▼	0.12▲	-0.17 ▼	0.10▲	-0.09 ▼	-0.19 ▼	0.06▲	0.60▲▲	0.32▲	-0.09 ▼
Prn-Al m	-0.65 ▼▼	-0.05 ▼	0.12▲	0.52 ▲▲	0.34▲	0.05▲	-0.02 ▼	0.42▲	0.13▲	-0.11 ▼
al r-prn-al l	0.26▲	-0.26 ▼	0.08▲	-0.65 ▼▼	-0.23 ▼	-0.56 ▼▼	0.23 ▼	-0.30 ▼	0.33▲	-0.68 ▼▼

▲: Positive weak strength of correlation, ▲▲: Positive Moderate strength of correlation, ▼: Negative weak strength of correlation, ▼▼: Negative Moderate strength of correlation, ▼▼▼: Negative Strong strength of correlation.

Results of Pearson's Correlation test between CBCT nostrils measurements and all cephalometric measurements that have been used in this investigation with purpose of determining facial growth pattern (according to Jarabak's analysis) within male subjects of the sample are presented in table 9.

Table 9 Pearson's Correlation test between CBCT nostrils measurements and the cephalometric measurements determining facial growth type (according to Jarabak's analysis) within female subjects of the sample.

	S	*Ar*	*GO1*	*Go2*	*Go*	*SA*	*S-Go*	*N-Me*	*Jarabak*	*Y*
Stn r-Stn l	0.31▲	-0.19 ▼	-0.09 ▼	-0.68 ▼▼	-0.57 ▼▼	-0.68 ▼▼	0.50 ▼▼	-0.17 ▼	0.68▲▲	- 0.29 ▼
Al r-Al l	0.05▲	-0.49 ▼	0.54 ▲▲	-0.32 ▼	0.15▲	-0.46 ▼	0.23▲	-0.04 ▼	0.32▲	- 0.62 ▼▼
ltn r-ltn l	0.23▲	-0.32 ▼	0.39▲	-0.15 ▼	0.17▲	-0.02 ▼	-0.29 ▼	0.01▲	-0.17 ▼	- 0.15 ▼
Ac r-Ac l	0.29▲	-0.48 ▼	0.41▲	-0.12 ▼	0.21▲	-0.13 ▼	0.05▲	0.08▲	-0.01 ▼	- 0.29 ▼
Stn r-ltn r	-0.47 ▼	0.18▲	-0.14 ▼	0.09▲	-0.03 ▼	-0.24 ▼	0.69▲▲	0.56▲▲	0.33▲	- 0.33 ▼
Stn l-ltn l	-0.47 ▼	0.09▲	0.10▲	0.15▲	0.18▲	-0.09 ▼	0.22▲	0.47▲	0.06▲	- 0.38 ▼
Prn-Al m	-0.06 ▼	-0.36 ▼	0.48▲	0.14▲	0.45▲	0.01▲	0.00 **no corr**.	0.24▲	-0.10▼	- 0.33 ▼
al r-prn-al l	0.13▲	-0.03 ▼	-0.09 ▼	-0.57 ▼	-0.48 ▼	-0.52 ▼▼	0.24▲	-0.38 ▼	0.50▲▲	- 0.23 ▼

▲: Positive weak strength of correlation, ▲▲: Positive Moderate strength of correlation. ▼: Negative weak strength of correlation, ▼▼: Negative Moderate strength of correlation.

DISCUSSION

This study showed that males have statistical significance greater CBCT measurements of Right and left length of the nostril, Nasal tip protrusion, and Alar slope angle than do the females (Tab.5). This was in agreement with Etöz (2008) [24], who evaluated the nasal shapes in both sexes and the related differences in the nostril forms according to gender. Li (2013) found significant differences in nasal indices of males and females of Han Chinese ancestry [25], and so Hwang (2003) found significant differences in nostril measurements of males and females in Koreans [26]. Furthermore, the differences among the two genders of the sample subjects were in the kind, strength and direction of the correlation between CBCT nostrils measurements and cephalometric measurements estimating facial growth type. However, male subjects showed stronger correlation comparing with female (Tab 8 & 9).

Correlation between CBCT nostrils measurements and the cephalometric measurements determining facial growth type (according to Jarabak's analysis) regardless of gender (tab.7) showed weak strength, and mostly of it was negative. However, Nasal width (Al r-Al l) has negative moderate strength of correlation with Jarabak sumangle (SA), and Y angle. This was more remarkably in adult male subjects of this study: (Y) angle have stronger, negative correlation with transversal measurements of the nostrils (Nasal width, Inferior width of the nostrils and Alar base width). This mean, in adult subjects: the more size increasing of the Nasal width the Growth Pattern will be more Hypodivergent (Counterclockwise) and the less size of the Nasal width the Growth Pattern will be more Hyperdivergent (Clockwise). Alar slope angle (al r-prn-al l) hade also negative moderate strength of correlation but with (Go2). Enlow (1966) noted that the nose becomes wider and increases noticeably in vertical size [27]. The nasal bridge becomes progressively more prominent in many persons; Enlow explained that because the entire face becomes longer in a vertical dimension as a composite result of mandibular ramus growth and downward growth of the nose and maxilla [27]. In adult female subjects of this study Superior width of the nostrils have the most strong correlation with cephalometric growth parameters (mostly negative), This mean, in adult male subjects: the more size increasing of the Superior width of the nostrils the Growth Pattern will be more Hypodivergent (Counterclockwise) and the less size of the Superior width of the nostrils, the Growth Pattern will be more Hyperdivergent (Clockwise). This also can be explained by Enlow while he suspected that in most of the persons studied, the nasal tip itself was seen lo drop in level as a result of continued anterior growth along the downward-facing anterior free margin of the nasal opening [27].

No previous researches studied the correlation between nostrils measurements and the facial growth types to compare with results of current study.

CONCLUSIONS

1. The present study reveal that CBCT nostrils measurements have differences with statistical significance between the two genders.
2. The differences among the two genders of the sample subjects were in the kind, strength and direction of the correlation between CBCT nostrils measurements and cephalometric measurements estimating facial growth type.
3. Nostrils morphology appears to vary with the type of facial growth, and have weak to moderate relationship with it.

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