مجلة جامعة تشرين للبحوث والدراسات العلمية _ سلسلة العلوم الصحية المجلد (37) العدد (5) 2015
Tishreen University Journal for Research and Scientific Studies - Health Sciences Series Vol. (37) No. (5) 2015

Relation between temporomandibular joint and normal growth pattern in female adult (CT scan study)

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(Received 10 / 6 / 2015. Accepted 29 / 9 / 2015)

☐ ABSTRACT ☐

The aim of this research is to investigate the dimensional and positional symmetries between the right and left condyles ,and the possible asymmetries between the condylar processes that could be related to the type of growth pattern in adult subjects with no clinical nor radiographic symptoms of TMDs.

Materials and methods: In result of a multistage clinical examination protocol, 14 Caucasian patients with normal growth pattern ,and with no prior orthodontics treatment were selected (14 females)from 17 to 29 years of age with no clinical signs and symptoms of TMDs.

The images obtained from the axial and sagittal slices, Cephalometric growth pattern study was performed. Pearson's Correlation Coefficient and T-test were calculated.

Results :no statistically significant relationship between the measurements of TMJ(left &right) and the normal growth pattern.

Conclusions:There is no relationship between the morphology of TMJ and normal growth pattern in adult female orthodontically non-treated .

Key Words: TMJ, growth pattern, Computed tomography ,condylar process.

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العلاقة ما بين المفصل الفكي الصدغي و نموذج النمو الطبيعي عند الاناث البالغين (دراسة باستخدام التصوير الطبقي المحوري)

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(تاريخ الإيداع 10 / 6 / 2015. قُبِل للنشر في 29 / 9 /2015)

□ ملخّص □

يهدف هذا البحث لتحري أبعاد وتوضع اللقم الفكية، ودراسة وجود تناظر بين اللقم الفكية اليمنى واليسرى ،أو عدم التناظر الممكن ملاحظته للناتئ اللقمي ومدى علاقة ذلك بنموذج النمو الطبيعي لدى عينة من الأفراد الاناث البالغين بدون اعراض سريرية او شعاعية لاضطرابات المفصل الفكي الصدغي.

مواد و طرق البحث: من خلال الاستعانة بالفحص الشعاعي و السريري متعدد المراحل، تم انتقاء 14 مريضة من العرق القوقازي ومن ذوي نموذج النمو الطبيعي، ممن لم يخضعوا لمعالجة تقويمية سابقة ، تراوحت أعمارهم بين17 و29 سنة، و بدون اي اعراض لاضطرابات المفصل الفكي الصدغي.

تم اجراء الدراسة على المقاطع السهمية والمحورية، ثم تم اجراء الدراسة السيفالومترية لتحديد نموذج النمو، ومن ثم تم اجراء تحليل معامل ارتباط بيرسون وتحليل ستيودنت.

النتائج: لم نجد ارتباطا ذو دلالة احصائية هامة ما بين قياسات المفصل الفكي الصدغي (الأيمن والأيسر) في المسقطين السهمي و المحوري، مع نموذج النمو الوجهي الطبيعي.

الخلاصة: لا يوجد ارتباط ما بين قياسات المفصل الفكي الصدغي (الأيمن والأيسر)،مع نموذج النمو الوجهي الطبيعي لدى أفراد من الاناث البالغين الغير خاضعين لعلاج تقويمي سابقا.

الكلمات المفتاحية: المفصل الفكي، نموذج النمو الوجهي ،التصوير الطبقي المحوري، الناتئ اللقمي .

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Introduction

Today it is very clear that the shape and function of the temporomandibular joints (TMJs) are intimately related and that the functional loads applied to them exert considerable influence on their morphology [1-2].

Mandibular movements are guided mainly by (TMJ), contact of the teeth, and the function of masticatory muscles. Understanding the trace of reaction of this forces acting across the temporomandibular joints (TMJ) is very intricate due to the complicated morphology and functional physiology of the TMJ [3].

The loads to which TMJs are submitted vary according to the subjects dentofacial morphologies, therefore, it can be suggested that condyle differ in shape in subjects with various growth patterns [4].

However, the influence of growth pattern on articular and TMJ morphology is still not completely Understood, because the mandible and the TMJ can be loaded differently in persons with diverse dentofacial morphologies [5], one could hypothesize that the condyle and the fossa might differ in shape between people with various malocclusions.

TMJ differences, related to facial morphology, have been reported in the literature [6-7], but the data are scarce and did not focus on the relation between temporomandibular joint and growth pattern.

One factor that has always jeopardized the visualization of the TMJs on conventional radiographic examination is the superimposition of neighboring structures.

Conventional radiographic examination has limitations for accurately showing the anatomic characteristics of TMJs. This is because the TMJ is a small joint with complex morphology surrounded by osseous tissues, which produce superimposition of images, particularly the petrous region of the temporal bone, the mastoid process, and the articular eminence [10-11].

Nowadays we used Computed tomography (CT) imaging which allows clear visualization of the areas of interest without superimposition and opens new perspectives for analyzing these joints with the possibility of determining the real dimensions of the structures under study[8-9].

Computed tomography (CT) scanning has tremendously improved the diagnosis of TMJ pathologies because it is an accurate, efficient, noninvasive, and fast diagnostic procedure. This is the method of choice for obtaining images of bone structures[8]. Moreover, these images allow precise determination of linear and angular measurements [9].

Since The shape and volume of the condyle in young adults is considered to play an important role in the stability of long-term orthodontic and orthognathic therapies it is important to us to know more about the relation between TMJ and normal growth pattern [12-13].

To our knowledge, no previous study has evaluated the association between the TMJ and facial growth in adult female subjects with no clinical or radiographic symptoms of temporomandibular Joint Disorders.

Study Objectives

The aim of this study is to investigate the association between the right and left TMJ measurements, and the normal growth pattern in adult female orthodontically non-treated subjects with no clinical or radiographic symptoms of temporomandibular disorders using CT scan.

MATERIALS AND METHODS

-Subjects

Sample's subjects were selected from patients who, anyway, had to have a CTscan for non-neurological disorders purpose, but not especially for this study. Subjects were submitted to strict a multistage clinical examination protocol in order to select adult subjects with normal growth pattern and with no clinical or radiographic symptoms of Temporomandibular Disorders.

Criteria for selecting the subjects:

1. No functional mandibular deviations, cross bites, open bites, facial asymmetry, or temporomandibular disorders.
2. No history of neurological disorders and/or neurological traumas.
3. No clinical or CT symptoms of neurological disorders and/or neurological traumas
4. No history of abnormal habits, normal nasal breathing
5. Subjects must have fully erupted permanent dentition up to second molar tooth.
6. No supernumerary tooth / supplementary tooth / missing tooth / impacted tooth.
7. No history of trauma to the dento-facial structures.
8. Exclusion criteria also were subjects with congenital anomalies/ evident signs of neurological impairment and/or syndromes and/or dento skeletal asymmetries and/or craniofacial malformation.

Sample estimation

To determine the minimum sample size to be statistically significant, a pilot study was realized on 14subject . 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 95% (Z = 2.58) at Confidence level of 99 %(i.e. significance level is 0.019), (σ): highest Standard Deviation value within the all the variables, (σ=6.95)

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

Thus:

$$n = \frac{(2.58)^2 (6.95)^2}{5^2} \approx 12.86$$

According to this pilot study, we determined that to get an exact estimate about the mean of patients' results, and the error in his estimate doesn't exceed 5 of the mean, with a significance level of 99%requires a sample size (n) of 12.86 patients as minimum, whereas the size of the sample in this study was n= 14 females.

-*Multistage clinical examination protocol:*

Subjects must have fully erupted permanent dentition up to second molar tooth with no supernumerary toot and /or supplementary tooth.

Personal data was collected from all subjects and they were questioned about clinical symptoms of TMDs. Subjects with bruxism ,polyarthritis, traumatic injuries and infections in TMJs, or any TMDs in there medical history, were excluded.

To exclude patients with compensated temporomandibular disorders, (these who usually give no TMDs history) a Manual Functional Analysis for Patients with no History of Symptoms according to Bumann was performed [14].

In result of the multistage clinical examination protocol and study of panoramic, only 48f patients (*14 females*) from 17 to 29 years of age, (*mean age Was 22.14 years*)with no clinical or radiographic signs and symptoms of Temporomandibular Disorders were selected to be as subjects for this current study.

-*computed tomography CT study:*

The CT images were obtained with the patients in centric occlusion (maximum dental intercuspation), The multislice CT was performed with a (GE,Bright Speed device, USA) at 120 kV and 350 mA. We obtained 0.5 mm thick slices .

-*CT TMJ measurements:*

<u>- The following measurements were assessed on the **sagittal** plane:</u>

S1: Superior joint space(Fig 1).[7]

S2: Anterior joint space(Fig 1). [7]

S3: Posterior joint space(Fig 1). [7]

GD: Depth of the mandibular fossa :measured from the most superior point of the fossa to the plane formed by the most inferior point of the articular tubercle to the most inferior point of the auditory meatus(Fig 2).[15]

GL: anteroposterior diameter of the mandibular fossa :The distance between the top of tuberculum articular and process postglenoidalis (Fig 2) .[15]

EH: The eminence height: was measured by the perpendicular distance between the lowest point of the articular eminence and the highest point of the fossa(Fig 3).[15]

Em A: The Eminence Angle (Em Angle):To evaluate the inclination of the articular eminence we utilized Frankfort/ Articular Eminence angle (FAE angle) suggested by Widman [32] and other researchers [16,17, 18] FAE angle formed by Frankfurt horizontal plane (FH) and the articular eminence tangent (AET)[16, 17, 18, 19, 20] (Fig 3).

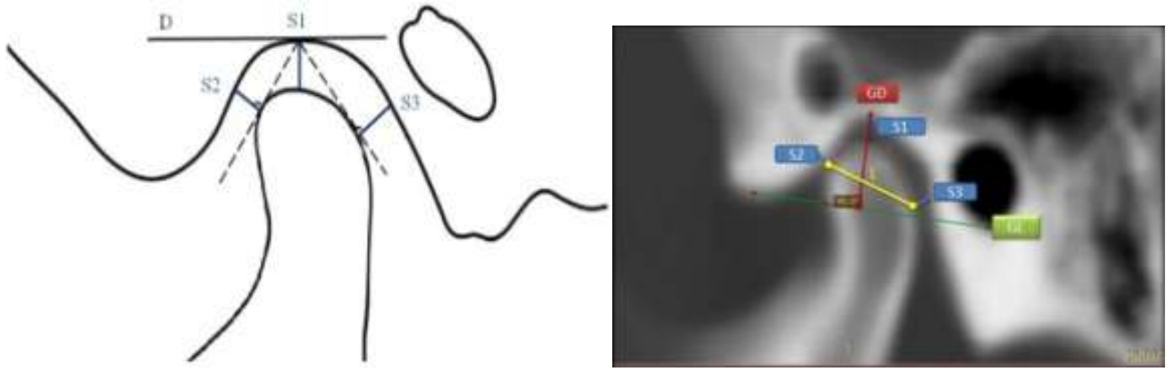


Fig 1.Joint space measurements: superior joint space (S1), Anterior joint space (S2), posterior joint space (S3), (D) superior horizontal line parallels Frankfort horizontal plane,(L) The greatest anteroposterior diameter of the mandibular condylar processes.

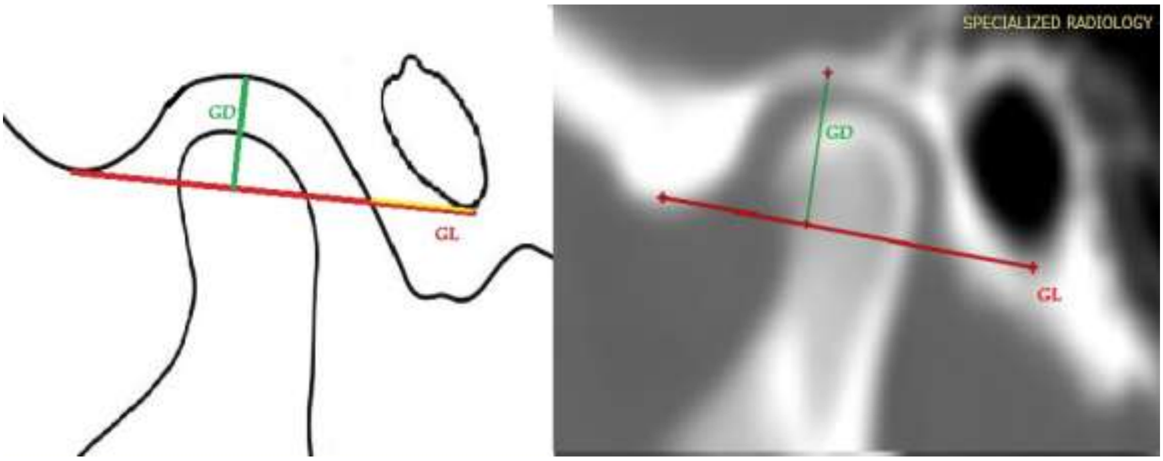


Fig 2.Depth(GD) and width(GL) of the mandibular fossa.

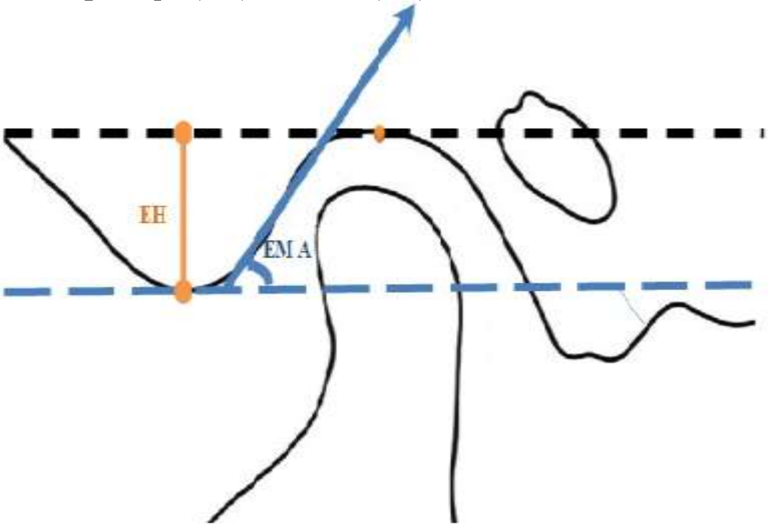


Fig 3.EM A:, The eminence Angle, EH: The eminence height.

<u>The following measurements were assessed on the **axial** plane:</u>

X: The angle between the long axis of the mandibular condylar process and the midsagittal plane (Fig 4).

A: The greatest mediolateral diameter of the Mandibular condylar process (Fig 4).

B: The greatest anteroposterior diameter of the mandibular condylar process(Fig 4).

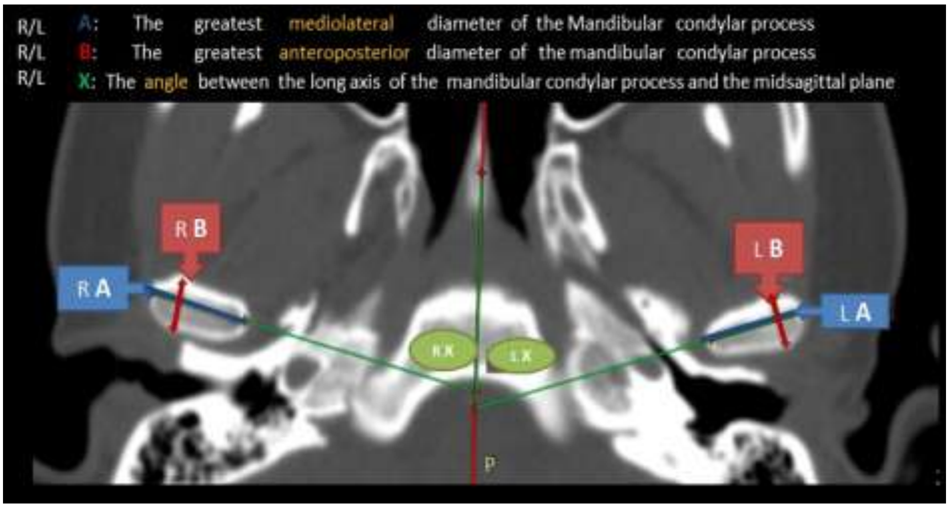


Fig 4. CT image representing: a, greatest mediolateral diameter of the mandibular condylar process;b, greatest anteroposterior diameter of the mandibular condylar process; X, lateromedial plane angle of the condylar process/ midsagittal plane ,MSP, midsagittal plane.

-lateral cephalometric analysis:

Facial growth was evaluated on the lateral cephalograms according to Jarabak analysis [22-23], 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 sum angle (SA), were determined and calculated according to Jarabak's analysis [22-23].

Cephalometrics points and measurements that have been used in this investigation according to Jarabak analysis showed in (Fig 6)..

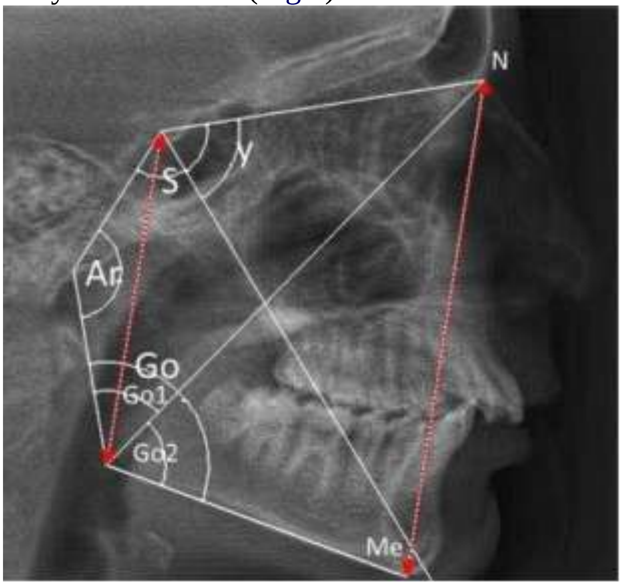


Figure 6.Cephalometrics points and measurements that have been used in this investigation according to Jarabak analysis .

Planes and lines that have been used in this investigation, were formed by the following facial components [24,25,26, 27, 28, 29]:

- (NSL): the plane of the anterior cranial base, it is a line drawn from nasion (N) to Sella (S),which it is the center of sella turcica.

-(S-Ar): A line drawn from the center of sella turcica (S) to articular (Ar), (Ar is the point of intersection of the dorsal contour of the articular processes of the mandibular condyle and the temporal bone).

-(Ar-Go): A line drawn from articular (Ar) to Gonion (Go) (Go is the point of intersection between lines tangent, to the base and ramus of the mandible.

Cephalometrics liner measurements that have been used in this investigation [24,25,26, 27, 28, 29]:

N-Me: Anterior facial height: A linear distance from Nasion to Menton.

S–Go: Posterior facial height: A linear distance from Sella to Gonion constructed.

Index I: This index is an expression of the proportion between the posterior and the anterior facial height. It represented Mandibular inclination [23].

Cephalometrics angular measurements that have been used in this investigation [24,25,26, 27, 28, 29]:

Saddle angle (S): an angle between anterior and posterior cranial base.

Articular angle (Ar): an angle between posterior cranial base and ramus height. Björk called (Articular angle): the angle at the temporomandibular joint [31].

Gonial angle (Go): an angle between lines tangent, to the base and ramus of the mandible.

Sum angles according to Björk (Björk∑): sum of angles Saddle angle (S), articular angle (Ar), and Gonial angle (Go).

Upper Gonial angle (Go1): an angle between ramus height and Gonion constructed-Nasion line (AR-GO-ME).

Lower Gonial angle (Go2): an angle between Gonion constructed-Nasion line and is the Mandibular plane

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

Error of method:

All 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 α= 0.05 to check any systematic error.

Random errors were checked using the Dahlberg formula. The t-test at the .05level did not show any significance.

−*Statistical method:*

Using (SPSS12), Pearson's Correlation Coefficient was calculated (amongst all the subjects, amongst males only, and amongst female only) to investigate:

the strength of a linear association of each of the TMJ measurements 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 sum angle (SA).Paired Student t tests were used for each measurement to evaluate the average of differences between the sides for each element of the sample.

RESULTS:

○Descriptive statistics for the age of female subjects of the sample are presented in (Table 1).

Table1.Descriptive statistics for the age of the female subjects of the sample.

	Count	Min	Max	Mean	Standard Deviation	Sample Variance
♀ *age*	14.00	17.00	29.00	22.14	3.82	14.59

○Descriptive statistics for CT TMJ measurements(right side) are presented in (table 2).

Table 2. Descriptive statistics for CTscan TMJ measurements(RIGHR SIDE)

RIGHT	Sex		RL	RS1	RS2	RS3	RGD	RGL	R_C_S	Em_A	Eh	Pullinger
Normal growth pattern	F	Mean	8.75 0	2.91 4	1.90 0	2.69 3	8.07 6	24.7 23	2.79	37.764	6.01 4	11.551
		N	14	14	14	14	14	14	14	14	14	14
		Std. Deviation	1.54 26	.581 6	.836 7	.910 2	1.58 59	1.61 02	1.626	5.0280	.920 6	22.9466

○Descriptive statistics for CT TMJ measurements (left side) are presented in (table 3).

Table 3. Descriptive statistics for CTscan TMJ measurements (LEFT SIDE)

LEFT	Sex		LL	LS1	LS2	LS3	LGD	LGL	L_C_S	Em_A	Eh	Pullinger
Normal growth pattern	F	Mean	8.797	2.971	1.779	2.679	8.396	24.6 93	2.79	38.22 1	5.8 64	11.186
		N	14	14	14	14	14	14	14	14	14	14
		Std. Deviation	1.2235	.9093	.4886	.7886	1.2400	1.62 69	1.626	3.604 7	.92 87	16.7002

CT TMJ measurements were compared between two sides(right & left) using a t-Test:Two-Sample Assuming Unequal Variances at α= 0.05 showed no statistical significance different between the two sides (right & left). P value of the t-Test are showed in (table 4).

Table 4. P value of t-Test for comparing CT TMJ measurements between the two sides.

t-test for Equality of Means			Levene's Test for Equality of Variances			
Sig. (2-tailed)	df	t	Sig.	F		
.668	94	.430	.725	.125	Equal variances assumed	L
.668	93.872	.430			Equal variances not assumed	
.660	94	-.441	.922	.010	Equal variances	S1

					assumed	
.660	93.982	-.441			Equal variances not assumed	
.930	94	.088	.928	.008	Equal variances assumed	S2
.930	93.746	.088			Equal variances not assumed	
.932	94	-.085	.134	2.282	Equal variances assumed	S3
.932	89.936	-.085			Equal variances not assumed	
.957	94	.054	.307	1.054	Equal variances assumed	GD
.957	91.510	.054			Equal variances not assumed	
.497	94	.683	.354	.868	Equal variances assumed	GL
.497	89.438	.683			Equal variances not assumed	
.637	94	.474	.457	.558	Equal variances assumed	C_S
.637	93.756	.474			Equal variances not assumed	
.850	94	.190	.198	1.683	Equal variances assumed	Em_A_A
.850	91.662	.190			Equal variances not assumed	
.700	94	.386	.837	.043	Equal variances assumed	Eh_A
.700	94.000	.386			Equal variances not assumed	
.633	94	-.480	.043	4.224	Equal variances assumed	Pullinger_A
.633	89.590	-.480			Equal variances not assumed	
.683	94	.410	.471	.524	Equal variances assumed	X
.683	93.280	.410			Equal variances not assumed	
.557	94	.589	.601	.275	Equal variances assumed	B
.557	93.645	.589			Equal variances not assumed	
.679	94	.415	.437	.611	Equal variances assumed	A
.679	93.222	.415			Equal variances not assumed	

The results of Pearson's Correlation between CT measurements of TMJ(sagittal plan/ right side) and the cephalometric measurements determining growth patterns within female subjects of the sample are presented in (Table5).

Table 5. Pearson's Correlation test between CT TMJ measurements(sagittal plan/ right side) and the cephalometric measurements determining facial growth type (according to Jarabak's analysis) within female subjects of the sample.

Female Sagital R	RL	RS1	RS2	RS3	RGD	RGL	REm A	REh	RPullinger
S	▼-0.27	0.10▲	0.26▲	▼-0.06	▼-0.03	0.36▲	▼-0.07	0.42▲	▼-0.35
Ar	▼-0.21	▼-0.32	▼-0.11	▼-0.19	0.12▲	▼-0.38	0.06▲	▼-0.16	0.10▲
Go1	0.38▲	0.39▲	0.01▲	0.33▲	▼-0.30	0.08▲	▼-0.09	▼-0.13	0.16▲
Go2	0.12▲	▼-0.03	▼-0.30	0.13▲	0.48▲	0.16▲	0.01▲	▼-0.18	0.32▲
Go	0.45▲	0.33▲	▼-0.27	0.42▲	0.19▲	0.23▲	▼-0.07	▼-0.29	0.44▲
Björk∑	▼-0.31	▼-0.02	▼-0.25	0.15▲	0.64▲▲	0.23▲	▼-0.13	▼-0.03	0.31▲
SN-GO ME	▼-0.31	▼-0.02	▼-0.25	0.15▲	0.64▲▲	0.23▲	▼-0.13	▼-0.03	0.31▲
S-GO	0.42▲	0.05▲	0.22▲	▼-0.36	0.13▲	0.26▲	0.50▲▲	0.22▲	▼-0.37
N-ME	0.43▲	0.09▲	0.19▲	▼-0.31	0.19▲	0.33▲	0.40▲	0.20▲	▼-0.29
Index.I	0.21▲	▼-0.09	0.21▲	▼-0.32	▼-0.11	▼-0.08	0.57▲▲	0.18▲	▼-0.44
Y axis	▼-0.69	▼-0.30	▼-0.15	0.02▲	0.05▲	▼-0.23	▼-0.25	0.29▲	▼-0.20

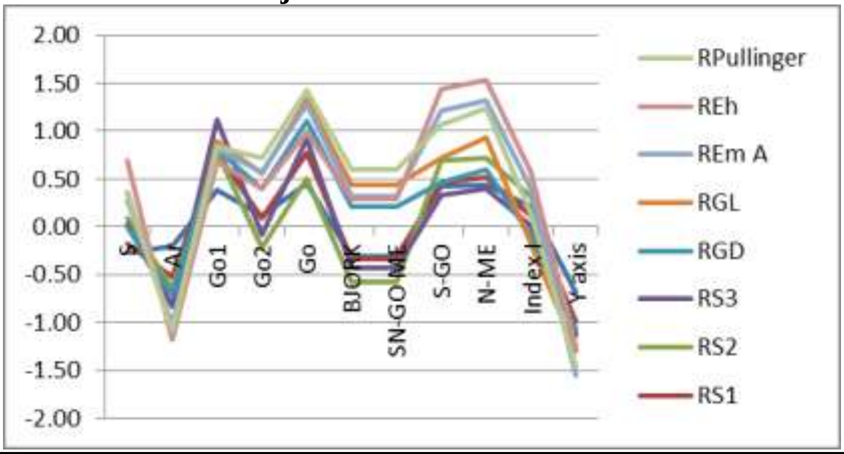
Where:

▲: Positive **weak** strength of correlation, ▲▲: Positive **Moderate** strength of correlation. ▲▲▲: Positive **Strong** strength of correlation

▼: Negative **weak** strength of correlation, ▼▼: Negative **Moderate** strength of correlation, ▼▼▼: Negative **Strong** strength of correlation.

-The results of Pearson's Correlation between CT measurements of TMJ(sagittal plan/ right side)and the cephalometric measurements determining growth patterns within female subjects of the sample visually shown in (Chart 1).

Chart 1: Results of Pearson's Correlation between CT measurements of TMJ(sagittal plan/ right side)and the cephalometric measurements determining growth patterns within female subjectsWith Normal Growth Pateerns of the sample



The results of Pearson's Correlation between CT measurements of TMJ (sagittal/ plan left side) and the cephalometric measurements determining growth patterns within female subjects of the sample are presented in (Table 6).

Table 6. Pearson's Correlation test between CT TMJ measurements(sagittal /plan left side) and the cephalometric measurements determining facial growth type (according to Jarabak's analysis) within female subjects of the sample.

Female Sagittal L	LL	LS1	LS2	LS3	LGD	LGL	LEm A	LEh	LPullinger
S	▼-0.35	0.10▲	0.28▲	0.12▲	▼-0.36	0.22▲	0.16▲	0.22▲	▼-0.33
Ar	▼-0.02	▼-0.17	▼-0.03	▼-0.08	0.47▲	▼-0.18	▼-0.12	0.07▲	0.09▲
Go1	0.21▲	0.13▲	▼-0.17	0.08▲	▼▼-0.63	▼-0.09	0.11▲	▼-0.33	0.15▲
Go2	0.05▲	▼-0.17	▼-0.36	▼-0.09	0.63▲	0.17▲	▼-0.42	▼-0.04	0.30▲
Go	0.24▲	▼-0.05	▼-0.49	▼-0.02	0.03▲	0.08▲	▼-0.30	▼-0.34	0.42▲
Björk∑	▼-0.39	▼-0.33	▼-0.41	0.00▲	0.52▲▲	0.14▲	▼▼-0.54	0.06▲	0.31▲
SN-GO ME	▼-0.39	▼-0.33	▼-0.41	0.00▲	0.52▲▲	0.14▲	▼▼-0.54	0.06▲	0.31▲
S-GO	0.55▲▲	0.28▲	0.30▲	▼-0.32	0.56▲▲	0.33▲	0.16▲	0.39▲	▼-0.35
N-ME	0.52▲▲	0.21▲	0.21▲	▼-0.38	0.65▲▲	0.39▲	0.02▲	0.42▲	▼-0.31
Index.I	0.39▲	0.36▲	0.45▲	0.00▲	0.19▲	0.04▲	0.48▲	0.12▲	▼-0.28
Y axis	▼-0.59	▼-0.17	0.18▲	0.24▲	0.13▲	▼-0.12	▼-0.21	0.36▲	▼-0.17

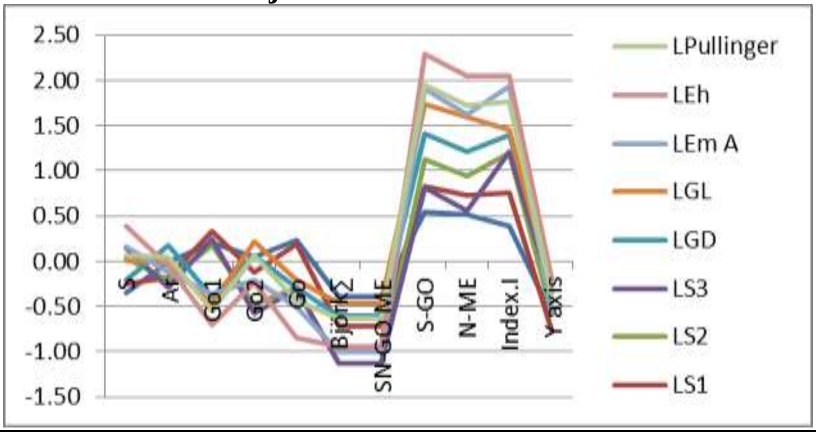
Where:

▲: Positive **weak** strength of correlation, ▲▲: Positive **Moderate** strength of correlation. ▲▲▲: Positive **Strong** strength of correlation

▼: Negative **weak** strength of correlation, ▼▼: Negative **Moderate** strength of correlation, ▼▼▼: Negative**Strong** strength of correlation.

-The results of Pearson's Correlation between CT measurements of TMJ(sagittal /plan left side)and the cephalometric measurements determining growth patterns within female subjects of the sample visually shown in (Chart2).

Chart 2: Results of Pearson's Correlation between CT measurements of TMJ(SAGITAL PLAN left SIDE)and the cephalometric measurements determining growth patterns within female subjects with Normal Growth Patterns of the sample



-The results of Pearson's Correlation between CT measurements of TMJ (axial plan) and the cephalometric measurements determining growth patterns within female subjects of the sample are presented in (Table7).

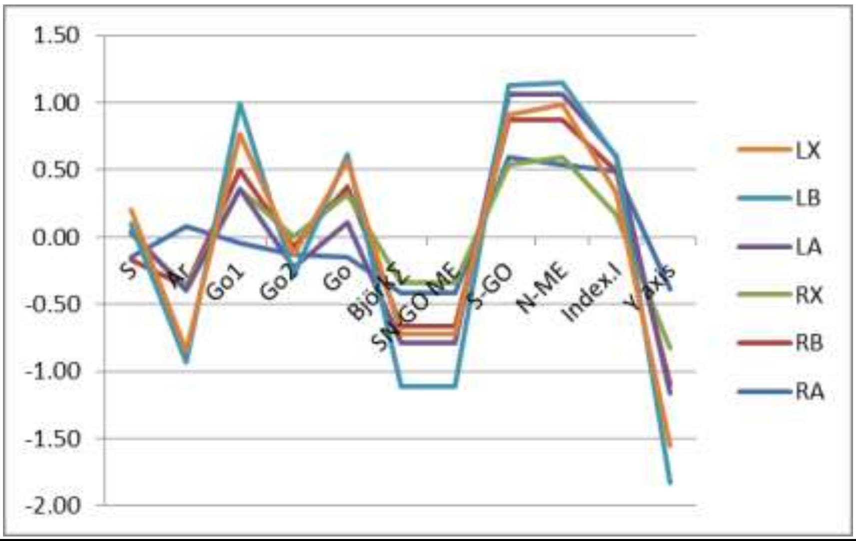
Table 7. Pearson's Correlation test between CT TMJ measurements(axial plan) and the cephalometric measurements determining facial growth type (according to Jarabak's analysis) within female subjects of the sample.

Female axial	RA	RB	RX	LA	LB	LX
S	▼-0.15	▼-0.02	0.19▲	0.02▲	0.06▲	0.10▲
Ar	0.08▲	▼-0.45	0.00▲	▼-0.03	▼▼-0.53	0.09▲
Go1	▼-0.04	0.54▲	▼-0.14	0.00▲	0.64▲	▼-0.22
Go2	▼-0.13	0.05▲	0.07▲	▼-0.22	▼-0.06	0.15▲
Go	▼-0.15	0.53▲	▼-0.06	▼-0.21	0.51▲	▼-0.05
Björk∑	▼-0.42	▼-0.25	0.32▲	▼-0.44	▼-0.32	0.39▲
SN-GO ME	▼-0.42	▼-0.25	0.32▲	▼-0.44	▼-0.32	0.39▲
S-GO	0.59▲▲	0.28▲	▼-0.33	0.52▲▲	0.06▲	▼-0.22
N-ME	0.54▲▲	0.34▲	▼-0.28	0.47▲	0.09▲	▼-0.17

Index.I	0.49▲	▼-0.00	▼-0.32	0.44▲	▼-0.01	▼-0.27
Y axis	▼-0.38	▼▼-0.71	0.26▲	▼-0.32	▼▼-0.67	0.28▲

- The results of Pearson's Correlation between CT measurements of TMJ(axial plan)and the cephalometric measurements determining growth patterns within female subjects of the sample visually shown in (Chart 3).

Chart 3: Results of Pearson's Correlation between CT measurements of TMJ(axial plan)and the cephalometric measurements determining normal growth patterns .



DISCUSSION:

In the process of sampling, we found there is no statically difference between left and right TMJ measurements in adult female subjects. (Tab 4)

This was in agreement with Man Matsumoto (1995) who found no statistically significant differences between sexes for anteroposterior or mediolateral condyle dimensions or depth of the glenoid fossa [31].

Whereas ,this was contrary to Wedel et al. (1978) and Hinton (1983) who founds that the values for mediolateral width were lower for women than for men, maybe because they study temporomandibular joint morphology in a medieval skull material [32-33].

<u>Within female sample's subjects</u>**<u>(Sagittal Plane),</u>** <u>Pearson's Correlation test showed</u>:

- weak strength (with different direction) of correlation between CT measurements of TMJ(right side/sagittal plan) and the cephalometric measurements determining growth patterns. (tab 5). Exclusion was a moderate, positive correlation showed By all of: R GD(with Björk∑, SN- GO ME) , R Em A (with S-GO, Index.I) .

-Pearson's Correlation test showed also weak strength (with different direction) of correlation between CT measurements of TMJ (left side /sagittal plane and the cephalometric measurements determining growth patterns.)(tab6)

Exclusion was a moderate, positive correlation showed By all of: L L(with S-GO, N-ME) , L GD(with Björk∑, SN-GO ME, S-GO, N-ME).

While a moderate, negative correlation showed by all of : LGD(with Go1), LEm A(with Björk∑, SN-GO ME).

In(**Axial Plane**) , Pearson's Correlation test showed :

-weak strength (with different direction) of correlation between CT measurements of TMJ(axial plan) and the cephalometric measurements determining growth patterns.

Exclusion was a moderate, positive correlation showed By all of: RA(with S-GO, N-ME), LA(with S-GO).While a moderate, negative correlation showed by all of: RB (with Yaxis), LB(with Ar, Yaxis).

- In adult female subjects of this study Depth of the mandibular fossa (GD) have the most strong(positive) correlation with cephalometric growth parameters (Björk∑, SN- GO ME), This mean: in adult female subjects: the more depth increasing of mandibular fossa the Growth Pattern will be more Hyperdivergent (Clockwise),and the less depth of the mandibular fossa, the Growth Pattern will be more Hypodivergent (Counterclockwise).

And we also noticed negative correlation showed by: Em A(with, Björk∑, SN-GO ME,GO,Y).

- In agreement with the results reported by (Droel & Isaacson) [29-30].In their research they have examined many components of the temporomandibular joint to assess its effect on mandibular growth and growth pattern. Relative changes in position of the glenoid fossa during facial development can occur as a result of local remodeling within the fossa or as a result of spatial repositioning of the entire temporal bone.

-(Droel & Isaacson) determined that growth may result in the glenoid fossa being positioned anteriorly or posteriorly [29]. In adult female subjects in our study: the less degree decreasing of The Eminence Angle (Em A) the Growth Pattern will be more Hyperdivergent (Clockwise),and the more degree increasing of The Eminence Angle, the Growth Pattern will be more Hypodivergent (Counterclockwise).

- (Agronin & Kokich) also agreed that as the glenoid fossa remodels with growth, it can affect condylar position and may contribute to forward positioning of the mandible or create mandibular rotation [30]. Their research evaluated displacement of the glenoid fossa in 175 orthodontically treated. Therefore, its relative position during facial development can truly affect mandibular position, growth direction and rotation.

CONCLUSION

1- No statically difference between left and right TMJ measurements in adult female subjects with normal growth pattern, and with no clinical or radiographic symptoms of Temporomandibular Joint Disorders.

2- In adult female subjects with no clinical or radiographic symptoms of Temporomandibular Joint Disorders Pearson's Correlation test showed weak strength (with different direction) between CT measurements of TMJ and normal growth pattern.

3- No relationship between the measurements of TMJ (both sides) with the cephalometric measurements determined according to Jarabak for estimating facial growth in adult female subjects with no clinical or radiographic symptoms of TMDs.

However, the relationship between the measurements of TMJ, remains variable, and is deserving of further study with big samples of both genders using CT as a safe and accurate technique for this porous.

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