Original Article

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RELATIONSHIP BETWEEN TEMPOROMANDIBULAR JOINT MORPHOLOGY AND FACIAL PATTERNS:A COMPUTED TOMOGRAPHY STUDY

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ABSTRACT:

The aims of this study were to investigate the possible association between the TMJ structure and facial pattern in subjects with no clinical or radiographic symptoms of TMDs, by using sagittal and axial slice computed tomography imaging.
In result of a multistage clinical examination protocol 60 Caucasian patients with no prior orthodontics treatment who had to have a CT scan for medical purpose, (but not especially for this study) were selected from 16 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 according to Jarabak. The facial and TMJ proportions data were analyzed using independent sample Student t-test and Pearson correlation analysis
Results: In subjects with no clinical or radiographic symptoms of Temporomandibular Joint Disorders, No significant differences in the joint spaces, and joint morphology between left and right TMJs were found.
There was a statistically significant relation between (condyle dimensions, Depth of the mandibular fossa, angle and height of the articular eminence) and facial patterns.
Pearson's Correlation test showed A significant correlation (with different direction and strength) between TMJ measurements and most of Cephalometrics facial pattern measurements .
Conclusion: In subjects with no clinical or radiographic symptoms of Temporomandibular Joint Disorders, there was a statistically significant relation between TMJ morphology and facial patterns.
The value of condyle dimensions, Depth of the mandibular fossa, angle and height of the articular eminence were significantly larger in Horizontal facial pattern than normal and vertical facial pattern.
Key Words: condylar symmetry, TMJ morphology, growth pattern, Computed tomography, temporomandibular joint, facial pattern.

INTRODUCTION

From the last few years, orthodontists have increased emphasis on relationship of TMJ and facial growth pattern, as it plays an important role in planning orthodontic treatment.

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

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morphology.(Mongini F 1972, Katsavrias EG and Halazonetis DJ 2005).

TMJ morphology has a strong correlation with skeletal morphology and exclusively an inverse relationship between the angle of the articular eminence and the Occlusal and the mandibular planes (Widman DJ 1988,Yamaki M et al 1990).

However, the influence of growth pattern on TMJ morphology is still not completely Understood, because the mandible and the TMJ can be loaded differently in persons with diverse dentofacial morphologies (Tanne K et al 1995), one could hypothesize that TMJ might differ in shape between people with various facial types.

TMJ differences, related to facial morphology, have been reported in the literature (Ingervall B 1974, Burke G et al 1998) , but it provides only limited data about the morphological variations associated with TMJ and growth pattern.

Many Previous studies used conventional radiographic methods . However, it is difficult to examine TMJ using conventional radiographs due to the superimposition of neighboring structures, such as the petrous region of the temporal bone, the mastoid process, and the articular eminence (Dawson PE 1996,Palacios E et al 1990).

Computed tomography (CT) imaging has become an alternative to conventional radiographic methods, because it facilitates a high quality image without superimposition (Katzberg RW 1989 , Kahl B et al 1995) , as well as a 3D reconstruction and analysis of the joints for determining the actual dimensions of the structures(Yañez Vico RM et al 2010).

Aim: The purpose of this study was to investigate, with CT imaging the possible association between TMJ morphology, and facial growth pattern in orthodontically non-treated patients with no clinical or radiographic symptoms of temporomandibular disorders .

MATERIALS AND METHODS

Sample's subjects were selected from patients who, anyway, had to have a CT scan for medical purpose, but not especially for this study. Subjects were submitted to strict a multistage clinical examination protocol in order to select subjects 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.

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.

In result of the multistage clinical examination protocol 60 patients from 16 to 29 years of age, (*mean age of 22.82 years; females average age was 22.52 years; males average age was 24.00 years*) with no clinical or radiographic signs and symptoms of Temporomandibular Disorders were selected to be as subjects for this current study.

The CT images were obtained with the patients in centric occlusion (maximum dental intercuspation), and their heads were positioned so that the Frankfort and midsagittal planes were perpendicular to the floor.

A multi-slice helical Light Speed (General Electric Healthcare, USA) scanner was used, generating images at 120kV tube voltage, 120mA tube current, 35sec scan time, 0.5mm slice thickness, to obtain the computed tomography images. Data was stored in DICOM (Digital Imaging and Communications in Medicine) format .

A personal computer Hp (Intel® Core-2CPU N570) was used, with the Windows 7 operating system.

-The following measurements were assessed on the sagittal plane:

S1: Superior joint space (Fig 1) . S2: Anterior joint space (Fig 1). S3: Posterior joint space (Fig 1) (Burke G et al 1998).

L : The greatest anteroposterior diameter of the mandibular condylar processes.

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 1). (Sümbüllü M A et al 2012).

GL: anteroposterior diameter of the mandibular fossa :The distance between the top of tuberculum articular and process postglenoidalis (Fig 1) (Sümbüllü M A et al 2012).

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 2) (Sümbüllü M A et al 2012).

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 and other researchers(Widman DJ 1988) FAE angle formed by Frankfurt horizontal plane (FH) and the articular eminence tangent (AET) (Fig 2).

The following measurements were assessed on the axial plane:

X: The angle between the long axis of the mandibular condylar process and the midsagittal plane (Fig 3).
A: The greatest mediolateral diameter of the Mandibular condylar process (Fig 3).
B: The greatest anteroposterior diameter of the mandibular condylar process(Fig 3).

-lateral cephalometric analysis:

The 60 subjects were divided into three groups according to facial growth pattern (Horizontal, normal and vertical) according to Jarabak analysis , 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 (Jarabak JR and Fizzell JA 1972, Reck KB and Miethke RR 1991).

Cephalometrics points and measurements that have been used in this investigation according to Jarabak analysis showed in (Fig 4).

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 $\alpha = 0.05$ to check any systematic error. The t-test did not show any statistical significance.

Statistical method:

All statistical analyses were performed using a software program (SPSS for Windows version 20).

The mean and standard deviation for each variable in the different growth patterns were calculated.

-Pearson's Correlation Coefficient was calculated 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).

Finally, to compare TMJ values, a “paired t-test” for the right and left sides was used.

RESULTS

The mean anterior joint space (s2) for the entire sample was 2.141± 0.746mm (mean ± s.d.),which was smaller than the remaining joint spaces.

The mean values of the TMJ measurements were larger in horizontal facial pattern than other facial pattern.

The mean values of the depth of glenoid fossa for the entire sample was 8.329 ± 1.331 . Depth of glenoid fossa (GD) in the vertical facial pattern had the smallest value.

For all the subjects, mean and standard deviation of TMJ measurements are given in (Table 1).

We noticed that there was a statistically significant relation between (L),(A),(B) and facial pattern, and we can say that the condyle dimension were significantly larger in Horizontal facial pattern than normal and vertical facial pattern.

(EMA ,EH, A,B) showed also a statistically significant relation with facial growth pattern as shown in table(2).

Results for comparing variables (TMJ measurements / sagittal & axial plane) among the 3 groups of facial pattern are presented in (table 2).

By use of a paired t-test, no significant differences of all the measurements were found between the left and right joints(Tab 3)

Pearson's Correlation test was performed to test the relationship between the CT measurements of TMJ with all Cephalometrics measurements that have been used in this investigation with purpose of determining growth patterns (regardless of gender). The results showed A significant correlation(with different direction and strength) between TMJ measurements and most of Cephalometrics facial pattern

DISCUSSION

Temporomandibular joint is a unique joint. Moreover ,TMJ is a rather difficult area for radiological investigation because there is no possibility for accurate evaluation of this position in conventional radiographs (Dalili Z et al 2012) .

Thus, more advanced techniques are needed to show anatomical relationships accurately (White SC and Pharoah MJ 2009).

Computed tomography (CT) imaging has become an alternative to conventional radiographic methods, because it provides images of the bony components of TMJ, and has the advantage of presentation of the three-dimensional details of bone structure(Hayashi T et al 1999) .

Therefore, three-dimensional construction of the TMJ is absolutely necessary to measure the joint spaces.

In this study , no significant differences in(the joint spaces, and joint morphology) between left and right TMJs were found.

This was in agreement with (Matsumoto MA ,Bolognese AM 1995) and (Kikuchi. K et al 2003).

Whereas ,this was contrary to (Rozencweig D 1975) and (Pullinger AG et al 1987), who founds significant differences in TMJ morphology between left and right TMJs, maybe because they study temporomandibular joint morphology in subjects with TMD.

We noticed also that there was a statistically significant relation between condyle dimensions(L , A ,B) and facial pattern, and the condyle dimensions were significantly larger in Horizontal facial pattern than normal and vertical facial pattern.

This was in agreement with Gomes SG et al (2011) and Durgha K (2014) .

Durgha K suggested that An increase in the function of the masticatory muscles is associated with anterior growth rotation pattern of the mandible and with well-developed angular, coronoid, and condylar processes.

According to Gomes SG et al (2011) the relative effort of masticatory muscles was higher in dolichofacial, followed by meso- and brachyfacial subjects .

SO The possible explanation for these findings is assumed to be that The high-occlusal-force group in Horizontal face pattern tended to have condyles with larger, more rounded form at the lateral and posterior side than the low-occlusal-force group in other facial types(Aya Kurusu et al 2009).

In the present study, The mean anterior joint space (s2) for the entire sample was smaller than the posterior joint space(S3),and the value of superior joint space was the greatest .

This was in agreement with (Ikeda K et al 2009, Dalili Z et al 2012 and Rozencweig D 1975), who suggested that the mandibular condyle was close to the temporal eminence under normal conditions and the anterior joint space was only a half of the posterior joint space.

Whereas, this was contrary to Hansson T et al (1977). Hansson directly measured disc thickness in autopsy materials and found that the thickness of the posterior and anterior bands were more than intermediate zone. In addition, the significant difference in the thickness of intermediate joint space can be due to ignoring the thickness of the soft tissues covering the fossa, the tissue shrinkage and muscle spasm after the death in Hansson et al study.

We also noticed that the superior joint space (S1) was bigger in Horizontal face pattern than other facial patterns. This was in agreement with Burke G et al (1998), according to him The increase superior joint space noted in the patients with a Horizontal facial pattern, may be representative of factors influencing joint space and spatial relationships.

Joint space is occupied by the disk, disk attachments and articular soft tissues, which may structurally change throughout an individual's lifetime (Hansson T et al 1977 , Hatcher DC et al 1986) . This may be due to remodeling and degenerative changes of the osseous and soft tissues, disk displacement with thinning of the posterior band, as well as postural positioning of the Mandible (Hatcher DC et al 1986).

Depth of the mandibular fossa (GD) showed a statistically significant relation with facial growth pattern, and it depth value was bigger in Horizontal face pattern than other facial patterns.

This mean the more depth of mandibular fossa increasing, the Growth Pattern will be more Hyperdivergent (Counterclockwise), and the more depth of the mandibular fossa decreasing, the Growth Pattern will be more Hypodivergent (clockwise).

Our results were in agreement with Droel R and Isaacson RJ (1972) .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.

Agronin KJ and Kokich VG (1987) 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. Therefore, its relative position during facial development can truly affect mandibular position, growth direction and rotation

The angle and height of the articular eminence (Em A,EH) showed also a statistically significant relation with facial growth , in addition, their value were bigger in Horizontal face pattern than other facial patterns.

This was in agreement with Durgha K (2014) who founds that TMJ morphology has a strong correlation with skeletal morphology and exclusively an inverse relationship between the angle of the articular eminence and the occlusal and the mandibular planes.

And this was in a agreement with Widman D.J (1988), who examined the association between the articular eminence angle and craniofacial morphology from cephalometric measurements, and demonstrated that the occlusal and mandibular planes became more horizontal when the articular eminence angle was larger.

Other studies also assumed that craniofacial morphology is associated with structural features of the TMJ such as the depth of articular eminence and the anteroposterior position of glenoid fossa (Ingervall B 1987).

This anatomical data may be helpful to understand the TMJ morphology. Additional studies on a larger number of samples are needed due to the variation, which might be present between different populations which may affect the TMJ measurements.

CONCLUSION

The present investigation identified some significant elements regarding TMJ morphology in different facial patterns.

In adult subjects with no clinical or radiographic symptoms of Temporomandibular Joint Disorders:

1-No significant differences in the joint spaces, and joint morphology between left and right TMJs were found.

2-The value of condyle dimensions, Depth of the mandibular fossa, angle and height of the articular eminence were significantly larger in Horizontal facial pattern than normal and vertical facial pattern.

3-There was a statistically significant relation between (condyle dimensions, Depth of the mandibular fossa, angle and height of the articular eminence) and facial patterns.

4-Pearson's Correlation test showed A significant correlation(with different direction and strength) between TMJ measurements and most of cephalometrics facial pattern measurements .

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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FIGURES:

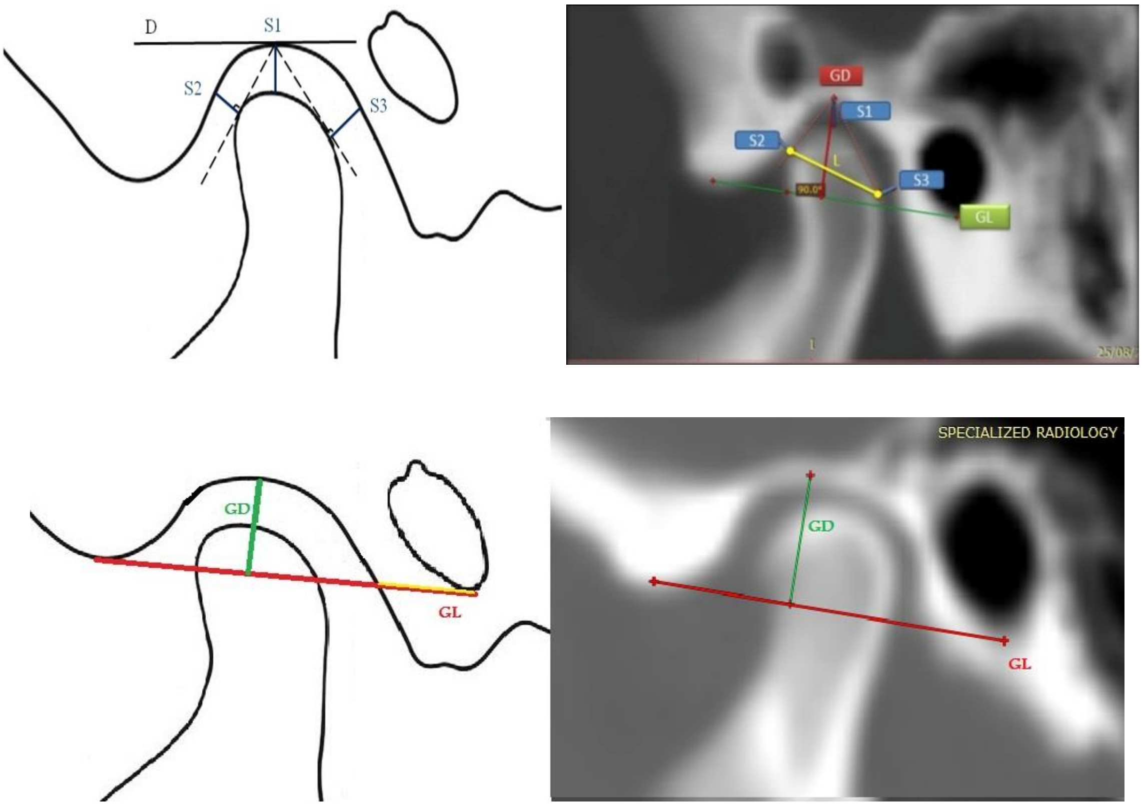

Fig 1.Joint space measurements: superior joint space (S1), Anterior joint space (S2), posterior joint space (S3), (D) superior horizontal line parallels Frankfort horizontal plane,(L) The greatest anteroposterior diameter of the mandibular condylar processes , (GD Depth) and (GL) width of the mandibular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

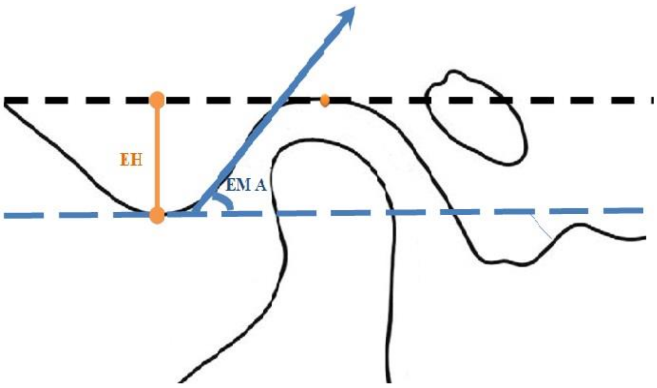

Fig 2.EM A:, The eminence Angle, EH: The eminence height.

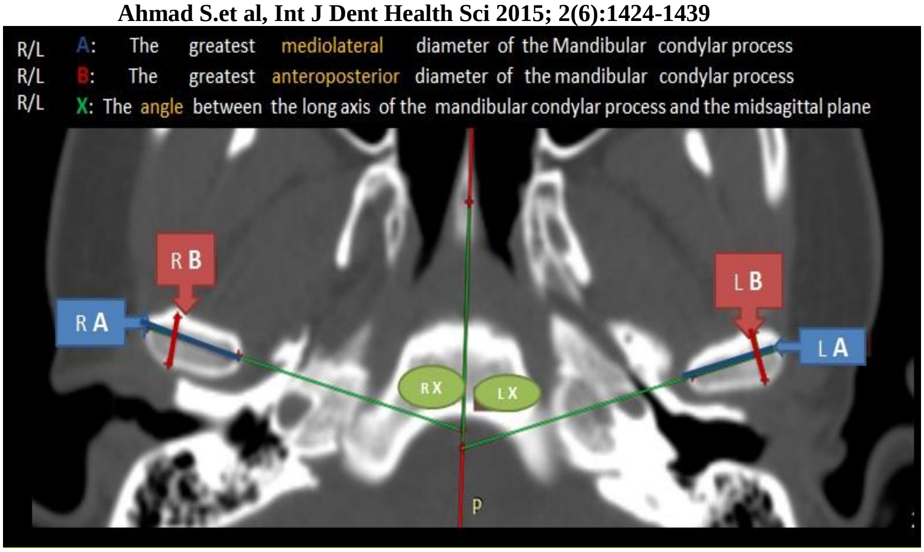

Fig 3. CT image representing: A, greatest mediolateral diameter of the mandibular condylar process;B, greatest anteroposterior diameter of the mandibular condylar process; X, lateromedial plane angle of the condylar process/ midsagittal plane ,MSP, midsagittal plane.

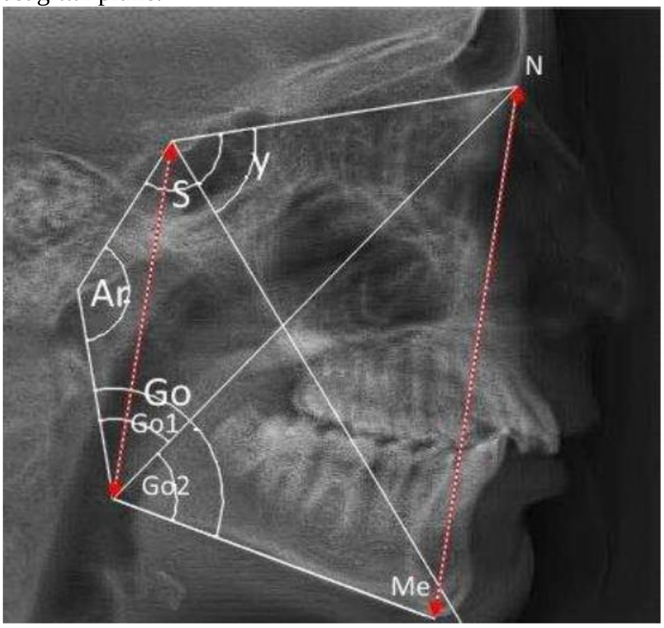

Figure 4.Cephalometrics points and measurements that have been used in this investigation according to Jarabak analysis .

TABLES:

Table 1. Descriptive statistics for CTscan TMJ measurements

Facial Pattern			**Sagittal Plane**								**Axial plane**		
	Sex	Side	**L**	**S1**	**S2**	**S3**	**GD**	**GL**	**Em_A**	**Eh_A**	**A**	**B**	**X**
Normal growth pattern	M	L	9.823	3.233	2.225	2.533	8.883	24.250	41.533	6.617	18.000	7.517	74.36
		R	9.033	2.833	1.950	2.650	9.250	24.400	42.533	7.067	18.150	7.483	74.4
		Total	9.428	3.033	2.088	2.592	9.067	24.325	42.033	6.842	18.075	7.500	74.383
	F	L	8.797	2.971	1.779	2.679	8.396	24.693	38.221	5.864	16.579	7.280	70.957
		R	8.750	2.914	1.900	2.693	8.076	24.723	37.764	6.014	16.800	7.243	71.143
		Total	8.774	2.943	1.839	2.686	8.236	24.708	37.993	5.939	16.689	7.261	71.050
	Total	**L**	**9.105**	**3.050**	**1.913**	**2.635**	**8.542**	**24.560**	**39.215**	**6.090**	**17.005**	**7.351**	71.980
		R	**8.835**	**2.890**	**1.915**	**2.680**	**8.429**	**24.626**	**39.195**	**6.330**	**17.205**	**7.315**	72.120
		Total	**8.970**	**2.970**	**1.914**	**2.658**	**8.485**	**24.593**	**39.205**	**6.210**	**17.105**	**7.333**	72.050
Vertical growth pattern	M	L	6.750	2.400	1.650	1.700	7.500	23.900	30.000	4.750	16.450	5.850	78.950
		R	6.500	2.900	1.750	1.900	7.900	24.700	35.000	5.100	16.500	6.000	79.350
		Total	6.625	2.650	1.700	1.800	7.700	24.300	32.500	4.925	16.475	5.925	79.150
	F	L	8.009	3.083	2.100	2.911	7.811	25.300	41.044	6.591	16.839	6.267	66.189
		R	8.023	3.211	2.056	3.022	7.987	24.271	40.433	6.356	16.422	6.311	65.828
		Total	8.016	3.147	2.078	2.967	7.899	24.786	40.739	6.473	16.631	6.289	66.008
	Total	**L**	**7.883**	**3.015**	**2.055**	**2.790**	**7.780**	**25.160**	**39.940**	**6.407**	16.800	6.225	67.465
		R	**7.871**	**3.180**	**2.026**	**2.910**	**7.978**	**24.314**	**39.890**	**6.230**	**16.430**	**6.280**	67.180
		Total	**7.877**	**3.098**	**2.040**	**2.850**	**7.879**	**24.737**	**39.915**	**6.319**	**16.615**	**6.253**	67.323
Horizontal growth pattern	M	L	10.305	3.900	2.100	2.578	7.750	26.300	41.375	7.350	20.750	7.975	67.775
		R	10.245	3.500	2.840	2.283	7.575	25.900	39.650	6.675	20.375	7.763	66.725
		Total	10.275	3.700	2.470	2.430	7.663	26.100	40.513	7.013	20.563	7.869	67.250
	F	L	9.694	3.313	2.519	2.638	8.844	24.110	45.738	7.338	19.144	7.331	70.106
		R	9.356	3.463	2.419	2.550	8.884	24.565	46.144	7.198	18.769	6.888	68.775
		Total	9.525	3.388	2.469	2.594	8.864	24.338	45.941	7.268	**18.956**	**7.109**	69.441
	Total	**L**	**9.816**	**3.430**	**2.435**	**2.626**	**8.625**	**24.548**	**44.865**	**7.340**	19.465	7.460	69.640
		R	**9.534**	**3.470**	**2.503**	**2.497**	**8.622**	**24.832**	**44.845**	**7.093**	19.090	7.063	68.365
		Total	**9.675**	**3.450**	**2.469**	**2.561**	**8.624**	**24.690**	**44.855**	**7.217**	19.278	7.261	69.003

Table 2. Results for comparing variables (TMJ measurements) among the 3 groups of facial growth pattern.

	Facial pattern		Normal facial pattern		Vertical facial pattern		Horizontal facial pattern			Horizontal - Normal	Horizontal - Vertical	Vertical - Normal
			Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation	p value	p value	p value	p value
sagittal plan	R	L	8.835	1.434	7.871	1.314	9.534	0.891	**	-	**	*
		S1	2.89	0.596	3.18	0.699	3.47	1.1801	-	*	-	-
		S2	1.915	0.7	2.026	0.657	2.503	0.746	*	*	*	-
		S3	2.68	0.7911	2.91	1.058	2.497	1.0794	-	-	-	-
		GD	8.429	1.7642	7.978	1.24	8.622	1.2871	-	-	-	-
		GL	24.626	1.3823	24.314	1.538	24.832	1.2649	-	-	-	-
		EMA	39.195	5.3877	39.89	5.706	44.845	6.2241	**	**	**	-
		EH	6.33	1.0378	6.23	0.948	7.093	1.2466	*	*	*	-
	L	L	9.105	1.2595	7.883	1.2017	9.816	1.1903	**	-	**	**
		S1	3.05	0.8088	3.015	0.7278	3.43	1.0692	-	-	-	-
		S2	1.913	0.5047	2.055	0.4454	2.435	1.08	-	-	-	-
		S3	2.635	0.7132	2.79	0.9199	2.626	0.8779	-	-	-	-
		GD	8.542	1.3722	7.78	0.832	8.625	1.2371	*	-	*	*
		GL	24.56	1.4394	25.16	1.8374	24.548	1.8073	-	-	-	-
		EMA	39.215	4.8057	39.94	4.7684	44.865	6.0429	**	**	**	-
		EH	6.09	1.1607	6.407	1.0406	7.34	1.084	**	**	**	-
Axial Plan	R	A	17.205	2.4408	16.43	1.8354	19.09	2.211	**	**	**	-
		B	7.315	0.9869	6.28	0.9117	7.063	1.4286	*	-	*	**
		X	72.12	6.4986	67.18	8.4005	68.365	5.8137	-	-	-	*
	L	A	17.005	2.4343	16.8	1.9353	19.465	2.598	**	**	**	-
		B	7.351	1.1292	6.225	0.7608	7.46	1.2028	**	-	**	**
		X	71.98	6.5885	67.465	8.4363	69.64	4.3559	-	-	-	*

Table 3. P value of t-Test for comparing CT TMJ measurements between the two sides according to facial growth pattern.

Facial Pattern		Horizontal					Vertical					NORMAL				
		L		R			L		R			L		R		
		Mean	S.d	Mean	Sd	P Value	Mean	S.d	Mean	Sd	P Value	Mean	S.d	Mean	S.d	P Value
sagittal plan	**L**	9.816	1.1903	9.534	0.891	0. 402	7.883	1.2017	7.871	1.3146	0. 976	9.105	1.26	8.835	1.434	**0.531**
	S1	3.43	1.069	3.47	1.18	0. 911	3.015	0.728	3.18	0.699	0. 469	3.05	0.809	2.89	0.596	**0.481**
	S2	2.435	1.08	2.503	0. 746	0. 818	2.055	0.445	2.025	0.657	0. 869	1.912	0.504	1.915	0.7	**0.99**
	S3	2.625	0. 878	2.496	1.079	0. 681	2.79	0.92	2.91	1.6	0. 704	2.635	0.713	2.68	0.791	**0.851**
	GD	8.625	1.237	8.622	1.287	0. 994	7.78	0.832	7.978	1.24	0. 557	8.542	1.372	8.429	1.764	**0.822**
	GL	24.548	1.807	24.83	1.264	0. 568	25.16	1.837	24.31	1.538	0. 123	24.56	1.439	24.626	1.382	**0.883**
	EMA	44.865	6.043	44.85	6.224	0. 992	39.94	4.768	39.89	5.706	0. 976	39.215	4.806	39.205	5.039	**0.99**
	EH	7.34	1.084	7.093	1.246	0. 508	6.407	1.04	6.23	0.948	0. 577	6.09	1.161	6.33	1.037	**0.495**
Axial Plan	**A**	69.64	4.356	68.37	5.814	0. 437	67.465	8.436	67.18	8.4	0. 915	71.98	6.588	72.12	6.498	**0. 946**
	B	7.46	1.203	7.063	1.428	0. 347	6.225	0.76	6.28	0.911	0. 837	7.351	1.129	7.315	0.986	**0. 915**
	X	19.465	2.598	19.09	2.211	0. 626	16.8	1.935	16.43	1.835	0. 539	17.005	2.434	17.205	2.44	**0. 797**