Cephalometric deviations present in children and adolescents with temporomandibular joint disorders

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Abstract

Introduction: Temporomandibular disorders (TMD) have proved to be a risk factor for developing hyperdivergent facial growth patterns. **Objective:** The aims of this study were: (1) Assess differences between the cephalometric measurements in children with articular TMD and a control group, before and after mandibular growth peak according to cervical vertebral maturation; and (2) Identify a predictive model capable of differentiating patients with TMD and control group patients based on early cephalometric characteristics. **Method:** The study included children and adolescents with maximum age of 17 years, divided into experimental group (n=30) diagnosed with articular TMD—according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) for children and adolescents—subdivided according to growth stage, called pre-peak (n=17) and post-peak (n=13) and control group (n = 30), matched by gender, skeletal maturity stage of the cervical vertebrae and classification of malocclusion. Lateral cephalometric and craniofacial structures were traced and their relations divided into: Cranial base, maxilla, mandible, intermaxillary relations, vertical skeletal relations and dental relations. Differences between the means for each variable were evaluated by applying the statistical Student t test for independent samples. **Results:** The means of the variables analyzed in the pre-peak showed no statistically significant differences. However, analysis of post-peak showed that the experimental group displayed decreased SNA and SNB and increased SN.Gn and 1.NB ($p<0.05$). **Conclusion:** It was possible to identify a predictive model able to differentiate patients with TMD and asymptomatic controls from early cephalometric characteristics.

Keywords: Facial growth. TMD. Malocclusion.

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INTRODUCTION

Although the treatment need for temporomandibular disorders (TMD) is directly related to pain and functional disability produced by these conditions, the presence of clinical signs and symptoms arising from changes in morphology and/or function of the temporomandibular joint (TMJ), such as joints sounds, are much more frequent.

Currently, the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD),[10] represents the most studied diagnostic tool regarding validity and accuracy of TMD's diagnostic classification based on specific diagnostic criteria. This system, through its physical axis, allows the possibility of multiple diagnoses for one individual, being the joint disorders divided into two broad categories not mutually exclusive: The disc displacements, with or without reduction; and arthralgia, osteoarthritis and osteoarthrosis of the temporomandibular joint.[10]

The RDC/TMD was not originally designed for use in children and adolescents, but was modified and validated for this purpose by Wahlund et al[33] and was later applied to this population group by several researchers.

Among the articular TMD, disc displacement with reduction may be clinically recognized by the occurrence of a clicking sound during opening and closing mouth movements, eliminated when the mouth is open sustaining maximum protrusion. In the diagnosis of articular disc displacement without reduction although there may be a history of joint clicks, the same must be absent at the time of diagnosis, associated with limitations and/or uncorrected deviation of mandibular movement.[10]

Degenerative changes of the TMJ are characterized by the presence of clinical signs of continuous joint sounds in the form of crepitus. According to RDC/TMD, crepitation can be accompanied by arthralgia, known as osteoarthritis or, in the absence of pain, osteoarthrosis.[10] The temporomandibular joint arthralgia is characterized by pre-auricular spontaneous pain or pain induced by palpation and/or function.[10]

Population studies about the prevalence of articular disorders' signs described above, in children and adolescents, showed that 8% to 29% of the assessed population showed clicking sounds in the TMJ, while only 1% displayed crepitus.[11]

Several factors distinguish the stomatognathic system of adults, children and adolescents, for example, the components of the masticatory system, which undergo different growth and development patterns.[32] During this development process, the craniofacial structures can be influenced by several factors such as congenital abnormalities,[15] uncontrolled hormonal levels,[13] arthritis,[17] condylar hypoplasia,[4] deleterious breathing habits,[34] trauma,[3] infections,[19] and orthopedic forces.[24] Such factors can alter the tissue adaptive capacity during growth and thus alter facial morphology.[25,26]

The studies that correlate articular TMD and facial growth patterns were conducted in adult patients,[1,2,6,16] as well as in children and adolescents.[24,25,26,31]

Thus, the involvement of TMJ by degenerative changes or disc displacements proved to be an important risk factor for identification of individuals with hyperdivergent facial growth patterns. However, the pathophysiological processes responsible for this relationship are not yet fully established.

Ahn et al[2] evaluated the presence or absence of anterior disc displacement diagnosis in 134 women, using magnetic resonance image (MRI). The means of 36 cephalometric variables were compared and the discriminant analysis model was conducted to determine which are the most important factors for identifying patients with anterior disc displacement.

The posterior position of the mandible, mandibular clockwise rotation, the increase of labial inclination of lower incisors and the increase of overjet intensified gradually with the progression of internal derangement of TMJ, and subjects with bilateral joint disorders showed the largest dentofacial morphological changes. Discriminant analysis was able to correctly classify 79% of subjects and demonstrated that those with the smallest angle between the long axis of the lower central incisor and the Frankfort plan and greater overjet had an increased risk to develop articular TMD.

The lack of knowledge regarding when the patient was affected by these disorders, which are more prevalent in ages subsequent to completion of facial growth, becomes a potential bias in establishing the real power of this association, which can be further important if early identified.

It seems therefore, important to identify, during the different stages of skeletal maturity that makes up the facial growth, signs of articular TMD, evaluating the real impact of these disorders on the facial growth pattern. It is expected therefore to show that the awaited changes in cephalometric measurements occur mainly in the later stages of facial development after the mandibular growth peak (stages III and IV of cervical vertebral maturation).

The aims of this study were: (1) To evaluate differences between the cephalometric variables selected for identification of facial growth pattern in children and adolescents with articular TMD and control group free of that disorder before and after the mandibular growth peak, according to cervical vertebral maturation (CVM) and (2) Identify a predictive model able to differentiate patients with TMJ disorders and asymptomatic controls based on early skeletal cephalometric characteristics.

MATERIAL AND METHODS

This study followed an observational and cross-sectional protocol, performed at the Preventive Orthodontics Clinic of the Petrópolis Medical School (Rio de Janeiro State, Brazil), including patients aged up to 17 years old of both genders. It was approved by the Scientific and Research Ethics Committee of the mentioned school.

Before performing any procedure all patients received detailed information about the research and signed a consent form.

The experimental group comprised 30 patients diagnosed with articular TMD, subdivided into two groups according to the corresponding growth period, named pre-peak of growth spurt (n=17) and post-peak of growth spurt (n=13). The inclusion criteria were: (1) Articular TMD Group II or III, according to Axis I of RDC/TMD for children and adolescents—the Portuguese version; (2) Good quality lateral radiographs obtained prior to orthodontic treatment, carried out in the same cephalostat (Cerdo Radiology Clinic, Petrópolis, RJ).

The following exclusion criteria were used: (1) Diagnosis of juvenile rheumatoid arthritis or other systemic joint diseases; (2) Orthodontic treatment prior to examination.

The control group consisted of 30 volunteers without TMD, matched by gender, cervical vertebral maturation index and Angle's classification of malocclusion. Inclusion criteria were the same adopted for the study group except for the need of articular TMD diagnosis, Groups II and III, according to Axis I of RDC/TMD for children and adolescents, Portuguese version, which becomes an exclusion criteria in addition to the others previously related to the study group.

The clinical examination conducted, part of the Axis I diagnosis protocol of RDC/TMD for children and adolescents, Portuguese version,[27] has been applied and validated in adolescents in previous studies,[33] comprising 10 question.

The lateral cephalometric radiographs were traced and the cephalometric points determined. The landmarks were digitized on an X-Y coordinate system through software Radiocef (Radio Memory, Belo Horizonte, MG, Brazil). Craniofacial structures and their relations were divided into the following categories for analysis: Cranial base, maxilla, mandible, intermaxillary relations, vertical skeletal and dental relations (Table 1, Figs 1, 2, 3 and 4).

The angular and linear measurements were taken from the analysis previously described by Downs,[9] Jarabak[14] and McNamara.[21]

The measures found were tabulated. Means and standard deviations for each variable in the patient sample were calculated using the statistical software SPSS (SPSS Inc, Chicago, USA).

The differences between the means for each of the variables selected for the group of patients with articular TMD and the control group were evaluated by applying Student t test for independent samples and the discriminant analysis with stepwise entry for patients in post-peak of pubertal growth spurt. The differences that had less than a 5% chance of having occurred by chance ($p<0.05$) were considered statistically significant.

To test the magnitude of the measurement error for the cephalometric variables in this study, the lateral radiographs of 15 patients and volunteers were randomly chosen and measured again. By applying Dahlberg's[8] formula, the error found was between 0.31 and 0.79 mm for linear measurements and 0.30 and 0.98° for angular measurements.

Cranial base	Maxilla	Mandible	Intermaxillary relationship
S-N (mm)	S.N.A (degrees)	S.N.B (degrees)	A.N.B (degrees)
S-Ar (mm)	Co.A (mm)	Co-Gn (mm)	N.A.P (degrees)
S.N.Ar (degrees)	NperpA (mm)	NperpPog (mm)	
		Go-Me (mm)	

Vertical Skeletal relationship	Dental relationships
Ans-Me (mm)	1.NA (degrees)
S-Go (mm)	1-NA (mm)
N-Me (mm)	1.NB (degrees)
Ar-Go (mm)	1-NB (mm)
S.Ar.Go (degrees)	1.1 (degrees)
Ar.Go.Me (degrees)	
SN.Go.Gn (degrees)	
SN.Gn (degrees)	
SN.PO (degrees)	
Ar.Go.Na (degrees)	
Na.Go.Me (degrees)	
Sum (degrees)	

TABLE 1 - Linear and angular cephalometric measurements.

RESULTS

Patients in the experimental group—articular TMD (n=30)—had a mean age of 9 years old (range 5-17 years old), being 12 individuals (40%) males and 18 (60%) females. Of these, 7 were in stage I of cervical vertebral maturation (23%), 10 in stage II (33%), 12 in stage III (40%) and 1 in stage IV (4%).

In the control group—no articular TMD (n=30)—the average age was 10 years old (range 5-14 years old), and presented the same distribution for gender and cervical vertebral maturation index found in the experimental group due to the pairing of the samples.

When the total experimental and total control groups were subdivided according to the stage of skeletal maturity, assessed by the cervical vertebral maturation index, into the subgroups pre-peak of pubertal growth spurt and post-peak of pubertal growth spurt, the means of the analyzed variables in the pre-peak of pubertal growth spurt period showed no statistically significant differences (Table 2).

However, the analysis of post-peak of pubertal growth spurt showed that the experimental group had mean values for SNA and SNB angles decreased, and the facial axis angle (SN.Gn) and lower incisor inclination (1.NB) increased in relation to the mean values found in the control group, revealing statistically significant differences (Table 3).

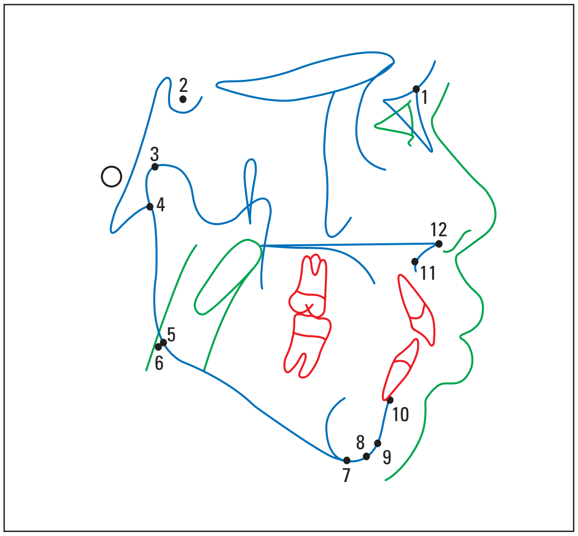

FIGURE 1 - Points used in this study: 1= N; 2= S; 3= Co; 4= Ar; 5= anatomic Go; 6= cephalometric Go; 7= Me; 8= Gn; 9= Pog; 10= B; 11= A; 12= Ans.

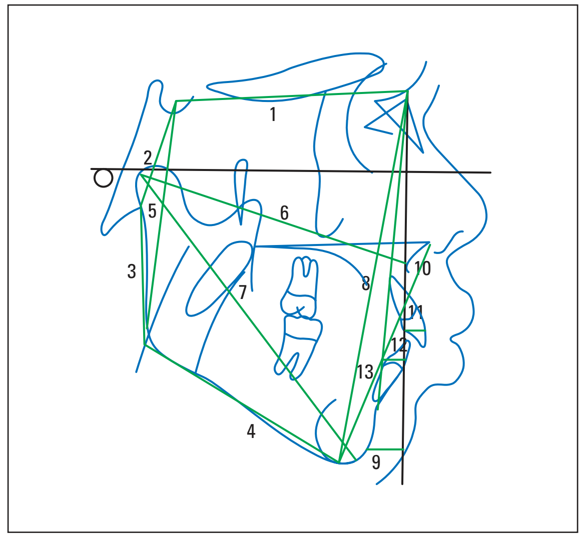

FIGURE 2 - Lines used in this study: 1= S-N; 2= S-Ar; 3= Ar-Go; 4= Go-Me; 5= S-Go; 6= Co-A; 7= Co-Gn; 8= N-Me; 9= NPog-P; 10= NA-P; 11= 1-NA; 12= 1-NB; 13= Ans-Me.

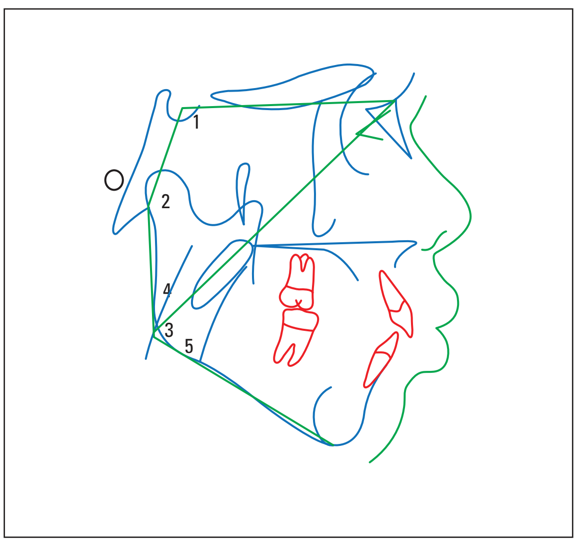

FIGURE 3 - Angles used in this study: 1= S.N.Ar; 2= S.Ar.Go; 3= Ar.Go.Me; 4= Ar.Go.Na; 5= Na.Go.Me.

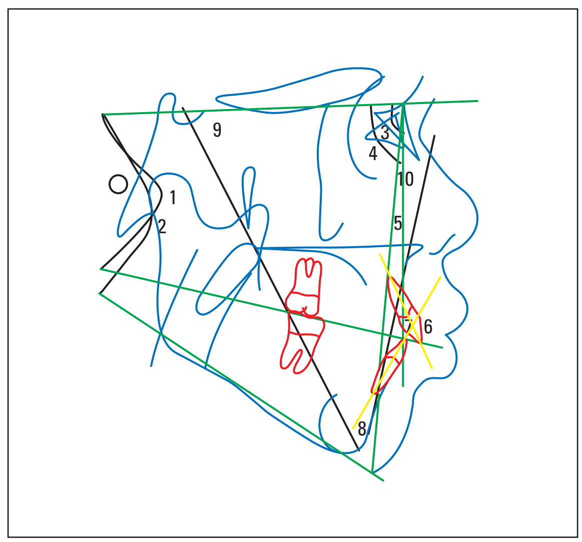

FIGURE 4 - Angles used in this study (continuation): 1= SN.PO; 2= SN.GoGn; 3= S.N.A; 4= S.N.B; 5= A.N.B; 6= $\underline{1}$.1; 7= 1.NA; 8= 1.NB; 9= SN.Gn; 10= N.A.Pog.

The discriminant analysis, with stepwise variable input, was applied only to variables whose differences between experimental and control groups had previously shown to be statistically significant. When performed in patients in the post-peak of pubertal growth spurt, as demonstrated by the cervical vertebral maturation index, it were selected two variables: SNA and lower incisor inclination. The discriminant function nonstandard coefficients led to the following equation, which gives each new subject an individual score to classify them as a patient with articular TMD or control.

Individual score = 0.829 X (S.N.A) – 0.645 X (1.NB)

TABLE 2 - Distribution of means and standard deviations for cephalometric variables in patients with pre-peak vertebral maturity.

Cephalometric variables	Experimental Group (mean± DP)	Control Group (mean± DP)	p
Cranial base			
S-N (mm)	67.35±3.53	66.44±5.04	0.546
S-Ar (mm)	32.37±3.04	30.56±4.44	0.176
S.N.Ar (degrees)	123.45±5.23	124.58±6.35	0.575
Maxilla			
S.N.A (degrees)	82.05±3.03	81.39±4.34	0.611
Co.A (mm)	84.17±6.25	83.91±8.35	0.921
NperpA (mm)	1.19±3.70	1.03±3.69	0.898
Mandible			
S.N.B (degrees)	4.30±1.91	3.98±4.63	0.799
Co-Gn (mm)	108.35±7.95	109.76±7.61	0.600
NperpPog (mm)	-5.52±6.38	-2.44±4.67	0.117
Go-Me (mm)	66.87±5.34	69.21±5.68	0.224
Intermaxillary relationship			
A.N.B (degrees)	4.30±1.91	3.98±4.63	0.799
N.A.P	8.57±4.53	6.71±7.21	0.375
Vertical skeletal relationship			
Ans-Me (mm)	64.31±63.79	63.79±4.65	0.788
S-Go (mm)	68.25±6.10	67.23±5.68	0.619
N-Me (mm)	110.40±7.96	110.24±7.69	0.952
Ar-Go (mm)	39.22±3.86	39.46±3.50	0.853
S.Ar.Go (degrees)	144.92±6.86	145.38±5.93	0.836
Ar.Go.Me (degrees)	129.66±6.75	126.15±5.37	0.104
SN.GoGn (degrees)	35.52±4.82	36.08±5.27	0.748
SN.Gn (degrees)	67.97±3.69	68.29±3.19	0.791
SN.Po (degrees)	18.17±4.59	18.15±4.19	0.990
Ar.Go.N (degrees)	53.77±5.43	52.27±2.76	0.316
N.Go.Me (degrees)	75.87±4.47	73.94±4.33	0.211
Sum	398.12±4.50	396.12±3.73	0.167
Dental relationships			
1.NA (degrees)	24.48±6.04	22.45±8.65	0.434
1-NA (mm)	4.38±1.77	4.62±2.30	0.737
1.NB (degrees)	31.25±7.24	26.56±8.54	0.094
1-NB (mm)	6.24±2.14	6.77±5.34	0.710
1.1 (degrees)	122.57±11.30	128.07±15.26	0.241

TABLE 3 - Distribution of means and standard deviations for cephalometric variables in patients with post-peak vertebral maturity.

Cephalometric variables	Experimental Group (mean± DP)	Control Group (mean± DP)	p
Cranial base			
S-N (mm)	70.85±3.47	67.81±5.23	0.094
S-Ar (mm)	33.93±3.20	33.58±3.74	0.801
S.N.Ar (degrees)	125.26±6.25	125.53±6.31	0.914
Maxilla			
S.N.A (degrees)	78.25±3.55	82.90±4.53	**0.008**
Co.A (mm)	86.19±5.73	87.93±3.69	0.368
NperpA (mm)	-0.13±4.04	2.79±3.63	0.065
Mandible			
S.N.B (degrees)	74.69±3.63	79.26±4.75	**0.011**
Co-Gn (mm)	114.51±7.80	115.94±3.46	0.552
NperpPog (mm)	-7.08±8.77	-2.52±7.95	0.178
Go-Me (mm)	73.03±5.84	72.97±3.35	0.974
Intermaxillary relationship			
A.N.B (degrees)	3.55±2.98	3.71±2.89	0.891
N.A.P	6.45±6.57	6.92±6.03	0.852
Vertical skeletal relationship			
Ans-Me (mm)	68.88±6.83	67.93±4.46	0.678
S-Go (mm)	73.42±6.42	72.99±4.36	0.842
N-Me (mm)	121.26±9.21	115.37±7.58	0.088
Ar-Go (mm)	42.18±3.53	43.12±3.99	0.532
S.Ar.Go (degrees)	146.10±7.19	141.92±7.34	0.155
Ar.Go.Me (degrees)	125.76±5.59	128.02±4.42	0.265
SN.GoGn (degrees)	38.59±7.15	34.35±4.87	0.090
SN.Gn (degrees)	72.08±5.13	67.85±4.12	**0.029**
SN.Po (degrees)	18.85±6.32	15.19±4.47	0.101
Ar.Go.N (degrees)	50.06±4.24	53.39±4.87	0.075
N.Go.Me (degrees)	75.82±6.25	74.66±4.31	0.588
Sum	397.18±7.90	395.45±4.41	0.499
Dental relationships			
1.NA (degrees)	27.38±5.05	23.90±7.83	0.190
1-NA (mm)	6.67±3.59	5.44±3.00	0.355
1.NB (degrees)	30.50±4.07	26.41±5.52	**0.042**
1-NB (mm)	6.41±4.85	5.64±2.02	0.603
1.1 (degrees)	119.26±6.34	124.86±10.29	0.108

The score found for the experimental group was 45.20 and for the control group was 51.96. The critical score, calculated as the average of the scores found for the experimental group and control group was 48.58. Thus the percentage of subjects correctly classified was 80.76%, leading to misclassification of 2 subjects in the experimental group (15.39%) and 3 control subjects (23.08%).

DISCUSSION

The condyle plays an active role in mandibular growth, which varies according to its cartilage primary potential. Children and adolescents have high adaptive capacity, so that the components of their TMJ and dentoalveolar regions undergo shape and size changes during growth.[12] Such changes tend to be more relevant during the pubertal growth spurt, which corresponds to the period of greatest relative mandibular growth.

The displacement of the articular disc has the ability to change the joint function, possibly exceeding the adaptive capacity of the growing tissues.[32] During mandibular growth, when proliferation of the condylar cartilage provides the joint fibrocartilaginous tissue, the articular disc displacement can result in rupturing of the cell proliferation layer. This disruption can reduce the formation of extracellular collagen and proteoglycan matrix, which contribute to the process of condylar growth.[20]

Experiments with animals, in which anterior displacements of the articular disc were surgically obtained in rabbits, and the posterior ligament kept intact over the condyle, demonstrated that the jaw of these animals became significantly shorter on the same side of the disc displaced, which resulted in a midline shift to the affected side. The mandibular asymmetry was not observed in the control group, with no displacement of the articular disc.[18]

These results suggest that the articular disc displacement precede the development of asymmetry of the jaw and can therefore be considered as risk factors for these conditions. However, if this sequence of events is relevant to human mandibular growth and development, it has not been determined yet, although it has been previously suggested.[25,26]

Mandibular asymmetries were also observed by Kambylafkas et al[16] in patients with unilateral osteoarthritis who had mandibular deviation to the affected side. The cephalometric measurements of patients revealed decreased condylar height and increased antegonial depth on the same side of the diagnosis of degenerative articular changes.

In this study, when the total experimental group and control group were subdivided according to the time of skeletal maturity, as assessed by cervical vertebral maturation index, into subgroups pre-peak and post-peak of pubertal growth spurt, the mean variables analyzed in the pre-peak of pubertal growth spurt showed no statistically significant differences.

However, the analysis of post-peak of pubertal growth spurt showed that the experimental group had greater maxillary and mandibular retrusion, increased facial convexity and labial inclination of upper incisors when compared to the control group. These results suggest that the compensatory skeletal and dentoalveolar changes resulting from TMJ disorders manifest themselves preferentially after the mandibular growth peak, a fact that has not been previously demonstrated.

Recently, several studies published, used magnetic resonance images (MRI) for the diagnosis of positional changes of the articular disc and degenerative diseases of the TMJ trying to correlate those diagnoses with changes on the craniofacial measurements of growing patients.[24,25,26,31] The results showed, almost unanimously, the establishment of a vertical facial pattern and retrognathia with dentoalveolar compensation consistent with this pattern.

However, the relatively high cost of MRI precludes its routine clinical indications for confirmation of the diagnosis of articular TMD, which can be detected clinically with acceptable levels of validity and accuracy.[22]

The compensatory proclination of lower incisors is probably related to increased overjet, arising from the posterior positioning of the mandible and its clockwise rotation. This rotation is associated with decreased height of the mandibular ramus found in patients with TMD in different studies.[1,25,26]

A relative maxillary retrusion, evaluated through the SNA angle, was observed in patients of the experimental group in the post-peak of pubertal growth stage when compared with the control group. Although it has been previously described in studies evaluating cephalometric characteristics of patients with TMD,[2,6] it has not been discussed satisfactorily, probably due to the absence of obvious relationship between intra-articular changes and maxillary growth. However, the SNA measure uses as reference point A, a dentoalveolar landmark and therefore capable of suffering the influence of possible dentoalveolar compensation on the superior arch due to mandibular changes.

Most published studies relating cephalometric variables and TMD suggest that the lateral cephalometric radiograph could be used to identify patients potentially suffering from internal disorders and/or degenerative changes of the TMJ.[1,2,6] Recently, certain variables selected from panoramic radiographs also demonstrated to be associated with the diagnosis of TMD,[7] opening the field for further research in this area.

However, in a study published by Bósio et al,[5] 56% of symptomatic women with bilateral disc displacement and Angle Class I malocclusion, displayed a mean value for the SNB angle (75.6°) significantly lower than the pattern observed in normal individuals. However, when women with similar articular diagnoses, but presenting Class II malocclusions were divided into Division 1 and Division 2 sub-groups, no statistically significant difference was found for the angle SNB when compared to normal individuals.

Thus, according to the authors, it would only be possible to diagnose—with acceptable degree of validity—the articular disc displacement based on lateral cephalometric radiographs when the patient develops typical signs or symptoms from TMD, Angle Class I malocclusion and SNB below the average calculated in the above described study (75.6°). This would make the prediction possible, but not very practical and definitely not diagnostic.

Therefore, the identification of certain cephalometric characteristics in specific patient groups can be considered an indicating factor for the necessity of diagnostic tools aimed at early identification of articular changes in children and adolescents, many times neglected.

The discriminant analysis was used previously to establish a predictive formula capable of classifying patients with TMD, with greater reliability.[2] The two variables selected by the stepwise process were: the inclination of lower incisors in relation to the Frankfurt horizontal plane and the amount of overjet. Thus, patients with internal derangement of the TMJ showed a lower incisor angle and greater overjet than in control subjects with normal joints. The discriminant analysis showed a higher validity in predicting patients with TMD (93.3%) than in the prediction of controls with normal joints (65.9%).

In this study, discriminant analysis was used to classify individuals as patients with TMJ disorders or healthy controls. The stepwise selection of significant variables pointed out two variables, the SNA angle and lower incisor inclination. Patients with TMD showed maxillary retrusion and labial inclination of lower incisors. In this study 80.76% of individuals were correctly classified, but 2 individuals in the experimental group (15.39%) and 3 individuals in the control group (23.08%) were misclassified.

The results of this study demonstrate a relationship between TMJ disorders in children and adolescents and the presence of a hyperdivergent pattern of facial growth. Even though the direction of this relationship can be assumed, it could not be determined due to the cross-sectional nature of this study, where the supposed risk factors and outcomes were assessed at the same time point. Therefore, the hypothesis of these disorders influencing on facial growth pattern must be confirmed by a longitudinal follow up to adulthood, from a growing cohort of patients, with and without TMJ disorders.

Future studies in this direction should also, ideally, consider the different sub-groups of patients with articular disc displacement, according to the RDC/TMD,[10] in the cephalometric evaluation of structural characteristics since, according to Bósio et al,[5] the position of the articular disc can influence the condylar position and thus the jaw position and their cephalometric measurements.

Ren, Isberg and Westesson[29] demonstrated that joints with disc displacement have more posterior condylar position than that found in normal joints. Likewise, Ronquillo et al[30] and Pullinger[28] suggested that patients with articular disc displacement with reduction show more posterior condylar position than in normal joints or cases of articular disc displacement without reduction. Supposing the hypothesis proposed by this study are accepted, more attention should be spent on early identification of clinical signs of TMJ disorders in early stages of development, which could be more appropriately diagnosed and measured by imaging techniques such as MRI. Thus, proper treatment protocols could be developed and introduced to avoid or minimize the undesirable influences of these disorders in facial growth pattern.

CONCLUSIONS

According to the study's findings, it can be concluded that:

1. Differences were found between cephalometric variables SNA, SNB, SN.Gn and 1.NB in children with articular TMD and control group free of that disorder, in the stages of cervical vertebral maturation before the mandibular growth peak.
2. It was possible to identify a predictive model able to differentiate patients with TMJ disorders and asymptomatic controls based on early skeletal cephalometric characteristics obtained by the variables SNA and 1.NB.

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