The relation between facial prognathism and cervical posture in skeletal class I Iraqi adult sample

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ABSTRACT

Background: Biologic mechanisms of the form-function interaction are one of important component of orthodontic diagnosis. The purpose of this study is to search for the statistical associations between natural postural and craniofacial morphologic variables of the head.

Materials and methods: The sample comprised natural head posture (NHP) cephalograms of 90 subjects, aged 18 to 25 years. Interpretation of the facial structure was made by using both intracranial and the extra-cranial reference lines in AutoCAD computer program.

Results The measures of anteroposterior maxillary position, SNA showed a low negative correlations with the anterior cranial base angulation to true vertical (SN.Ver) and with the cranio-cervical position of the head (SN.OPT),(SN.CVT) The measures of anteroposterior mandibular position, SNB and SNPog, both showed moderate correlations with the anterior cranial base angulation to true vertical (SN.Ver) and with the cranio-cervical position of the head (SN.OPT),(SN.CVT) .

Conclusion Regarding the correlations between the variables indicating the degree of facial prognathism in the NHP, and the postural variables of the cervical column, it can be argued that in subjects with forward cervical inclination, a relative decrease in facial prognathism is expected.

Keywords: natural head posture, AutoCAD computer program. (J Bagh Coll Dentistry 2013; 25(3):149-152).

INTRODUCTION

In the orthodontic literature, there are a number of studies of associations between head posture and dentofacial morphology [1-6]. These studies led to the development of the so called "soft tissue stretching" hypothesis[7].

According to Bench [8] vertical growth of the face after puberty has a high correlation with neck growth, so that patients with dolicocephalic faces often have a tendency for the cervical column to be straight and long, whereas brachycephalic patients often have a curved cervical column. In line with this concept, it was suggested by Houston[9] that the growth of the cervical column is the primary factor determining growth of anterior face height.

The atlas was considered of particular interest to the orthodontist. Von Treuenfels [10] observed that the inclination of the atlas is associated with the sagittal jaw position in that the ventral arch of the atlas attains a more cranial position in progenic than in orthogenic patients.

In order to obtain optimal cephalometric assessment of craniocervical angulations, it has been strongly advocated that the lateral cephalograms should be taken with the teeth in occlusion and the subject sitting upright [3]or standing upright [2]with the head and cervical column in the natural position [(2, 4)]

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Natural head position is the relationship of the head to the true vertical [11]; in cephalometric radiographs it is a standardized orientation of the head in space. Since the natural head position uses an extra-cranial reference line, it obviates reliance on any intracranial reference planes [13.]

The aim of this study was to search for the associations between postural and morphologic variables of the head in a sample taken from Iraqi population. Examining more specifically whether the head extension or flexion could affect the facial anteroposterior relation.

MATERIALS AND METHODS

Samples selection

Ninety lateral cephalometric digital radiographs in natural head position (NHP) were collected from students at the College of Dentistry, University of Baghdad, and subjects attended the Orthodontic Department of the Baghdad dental college. The age ranged between 18-25 years with a class I skeletal relationship, the value of ANB 2-4^{o}. Every lateral cephalometric radiograph was analyzed by AutoCAD program 2011 to calculate the cephalometric measurements on which the points and planes were determined, and then the measurements were obtained.

Landmark definitions

The reference points of this study are shown in Fig. 1. The following points were used in this study and defined according to Rakosi [12]: Sella (S), Nasion (N), Point (A), Point (B), Pogonion (Pog).

The following points were used in this study and defined according to Solow and Tallgren[2]:

1. **cv2ap** - the apex of the odontoid process of the second cervical vertebrae.
2. **cv2ip** - the most posterior and inferior point on the corpus of the second cervical vertebrae.
3. **cv2tg -** tangent point of OPT on the odontoid process of the second cervical vertebrae.
4. **cv4ip -** the most posterior and inferior point on the corpus of the fourth cervical vertebrae.

Reference lines

The cephalometric reference lines (Fig. 1), used in this study according to Solow and Tallgren[2] are:

1. **True vertical reference line (VER)**: This line passes through point PNS, parallel to the radiographic image of the vertical chain, and is 90° to the true horizontal.
2. **True horizontal reference line (HOR)**: the line perpendicular to VER.
3. **Odontoid process tangent (OPT)**: The posterior tangent to the odontoid process through cv2ip.
4. **Cervical vertebrae tangent (CVT)**: The posterior tangent to the odontoid process through cv4ip.
5. **Sella nasion (SN)** [12]**:** Anteroposterior extent of anterior cranial base.

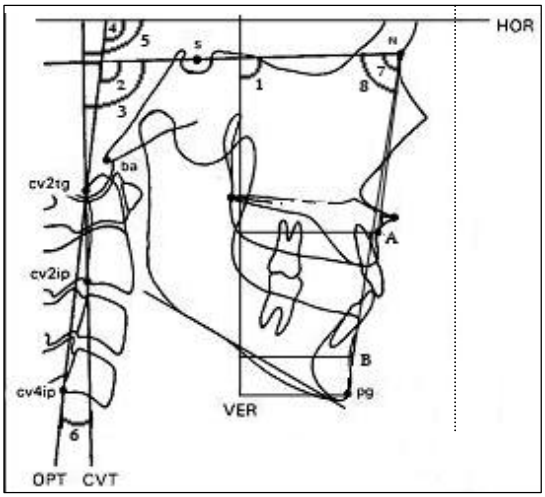

Figure 1.The reference points and lines of this study

Variables (Table I., Figure: 2)

1. **SN-VER** the anterior cranial base in relation to the true vertical line - angle between the SN line and the true vertical line.
2. **SN - OPT** - the head position in relation to the cervical column - angle between the SN line and the odontoid process tangent (OPT)[2]**.**
3. **SN - CVT** - the head position in relation to the cervical column -angle between the SN line and the cervical vertebrae tangent (CVT)[2].
4. **OPT-HOR** - the inclination of cervical column to the true horizontal - angle between the odontoid process tangent (OPT) and the horizontal line (HOR) [2].
5. **CVT-HOR** - the inclination of cervical column **to** the true horizontal - angle between the cervical vertebrae tangent (CVT) and the horizontal line (HOR) [2]
6. **OPT-CVT** - the inclination of the two cervical reference lines to each other, i.e. the cervical curvature- angle between the odontoid process tangent (OPT) and the cervical vertebrae tangent (CVT) [2]
7. **SNA:** Anteroposterior position of maxilla in relation to anterior cranial base [(12)].
8. **SNB:** Anteroposterior position of mandible in relation to anterior cranial base [(12)].
9. **SNPog:** Anteroposterior position of chin in relation to anterior cranial base [(12)].
10. **N-VER:** distance of N to true vertical[2]
11. **A-VER:** distance of A to true vertical[2]
12. **B-VER:** distance of B to true vertical[2]
13. **Pog-VER:** distance of Pog to true vertical[2]
14. **A-VER/N-VER:** Ratio indicating maxillary prognathism in the NHP[2].
15. **B-VER/N-VER:** Ratio indicating mandibular prognathism in the NHP[2].
16. **Pog-VER/ N-VER:** Ratio indicating chin prognathism in the NHP[2].

Table 1. The variables studied

Postural Variables	
Intra-cranial	**Extra-cranial**
SN - OPT	OPT-HOR
SN - CVT	CVT-HOR
SN-VER	OPT-CVT
Facial prognathism	
Intra-cranial	**Extra-cranial**
SNA	A-VER/ N-VER
SNB	B-VER/ N-VER
SNPog	Pog-VER/ N-VER

Figure 2. The reference points and lines in AutoCAD program.

Statistical Analysis

Data were statistically analyzed by a software computer program SPSS, version 15 to obtain descriptive statistics (means, standard deviation), and Pearson's correlation.

RESULTS

The mean values for the craniofacial dimensions and head posture in the study are shown in Table 2.

Anteroposterior maxillary position (Table 3)

The measures of anteroposterior maxillary position, SNA showed a low negative correlations with the anterior cranial base angulation to true vertical (SN.Ver) and with the cranio-cervical position of the head (SN.OPT), (SN.CVT). These correlations were significant at .001 level. The extra-cranial Anteroposterior measures (A.Ver/N.Ver) showed a low correlation with the cervico-horizontal posture of the head (OPT.HOR), (CVT.HOR) and a negative correlation with cervical curvature (OPT.CVT) these correlations were significant at .001 level.

Anteroposterior mandibular position (Table 3)

The two measures of anteroposterior mandibular position, SNB and SNPog, both showed moderate correlations with the anterior cranial base angulation to true vertical (SN.Ver) and with the cranio-cervical position of the head (SN.OPT), (SN.CVT). These two correlations were significant at .001 level. The extra-cranial Anteroposterior measures (B.Ver/N.Ver) (Pog.Ver/N.Ver) showed a low correlations with the cervico-horizontal posture of the head (OPT.HOR),(CVT.HOR) and a negative correlation with cervical curvature (OPT.CVT) these correlations were significant at .001 level.

Table 2. Descriptive statistics of craniofacial and head posture measurements

Variables		Mean	SD
Sagittal dimensions			
Intra-cranial	**SNA**	84.00	3.2
	SNB	80.08	3.5
	SNPog	80.56	3.7
Extra-cranial	**A.Ver/N.Ver**	1.04	0.1
	B.Ver/N.Ver	0.94	0.1
	Pog.Ver/N.Ver	0.96	0.1
Head posture			
Intra-cranial	**SN.Ver**	97.96	3.7
	SN.OPT	106.00	5.1
	SN.CVT	105.36	6.9
Extra-cranial	**OPT.HOR**	98.08	3.7
	CVT.HOR	97.80	4.4
	OPT.CVT	3.04	2.3

DISCUSSION

The main goal of study was to search for the associations between posture and structure of the head, and to make some assumption about the possible control mechanisms in craniofacial growth and development.

All patients were selected for skeletal classification according to the ANB angle. Only Class I patients with a normal vertical growth pattern were included in the study sample. Thus, this study differed from previous studies as a standard and homogenous group of patients was used.

As it was aimed to assess the shape of the craniofacial complex, no linear measurements that may show wide variations in persons having similar facial configurations were used. Sex differences in craniofacial structure found to exist in linear measurements, rather than in angles therefore, in this study, no distinction was made with regard to sex.[14]

In this study, conventional angles SNA, SNB, and SNPog were correlated with cranio-vertical and craniocervical postural parameters (SN.VER, SN.OPT, and SN.CVT). This is in agreement with the findings of previous studies.[2,6]

However, when the facial prognathism was assessed in the NHP with parameters that were based on the extracranial reference lines (A-VER/N-VER, B-VER/N-VER, and Pog-VER/N-VER), they showed positive correlations with SN.VER and negative correlations with the parameters that indicated cervical posture (OPT.HOR and CVT.HOR). It could thus be assumed that, although an increase in the inclination of the sella-nasion reference line results in the relative anterior positioning of the points A, B, and pogonion, in relation to nasion, values of the angles SNA, SNB, and SNPog decrease topographically, which may falsely lead to a conclusion that facial prognathism decreases with the extension of the head. It should be remembered that the inclination of the S-N reference line is mainly due to the vertical anatomic location of sella-turcica, in the NHP.

Regarding the correlations between the variables indicating the degree of facial prognathism in the NHP, and the postural variables of the cervical column, it can be argued that in subjects with forward cervical inclination, a relative decrease in facial prognathism is expected. In agreement with the findings of Solow and correlation with the inclination of the cervical column [2,4].

REFERENCES

1. Schwarz AM. Positions of the head and malrelations of the jaws. Int J Orthod 1928; 14: 56-68.
2. Solow B, Tallgren A. Head posture and craniofacial morphology. Am J Phys Anthropol 1976; 44: 417-35.
3. Marcotte MR. Head posture and dentofacial proportions. Angle Orthod 1981; 51: 208-13.(IVSL)
4. Solow B, Siersbaek-Nielsen S. Growth changes in head posture related to craniofacial development. Am J Orthod 1986; 89:132-40.
5. Hellsing E, McWilliam J, Reigo T, Spangfort E. The relation between craniofacial morphology, head posture and spinal curvature in 8, 11-and 15-year-old children. Eur J Orthod 1987; 9: 254-64.
6. Showfety KJ, Vig PS, Matteson S, Phillips C. Associations between the postural orientation of sella-nasion and skeletodental morphology. Angle Orthod 1987; 57: 99-112. (IVSL).
7. Solow B, Kreiborg S. Soft tissue stretching: a possible control factor in craniofacial morphogenesis. Scand J Dent Res 1977; 85: 505-7.
8. Bench RW. Growth of the cervical vertebrae as related to tongue, face, and denture behaviour. Am J Orthod 1963; 49: 183-214.
9. Houston WJB. Mandibular growth rotations - their mechanisms and importance. Eur J Orthod 1988; 10: 369-73.
10. Treuenfels von H. Die Relation der Atlasposition bei prognather und progener Kieferanomalie. Fortschr Kieferorthop 1981; 42: 482-4.
11. Cole SC. Natural head position, posture and prognathism: the Chapman prize essay, 1986. Br J Orthod 1988; 15: 227-39.
12. Rakosi T. An atlas and manual of cephalometric radiography. 2nd ed. London: Wolfe medical publications Ltd.; 1982.
13. Moorrees CFA, Kean MR. Natural head position, a basic consideration in the interpretation of cephalometric radiographs. Am J Phys Anthropol 1958; 16: 213-34.
14. Ingerslev CH, Solow B. Sex differences in craniofacial morphology. Acta Odont Scand 1975; 33: 85-94.

Table 3. Significant correlations (R) between the morphology of the cervical column and craniofacial morphology and head posture in the total group

Sagittal dimensions	Head posture					
	Correlation	Sig.	Correlation	Sig.	Correlation	Sig.
Intra-cranial	**SN.OPT**		**SN.CVT**		**SN.Ver**	
SNA	-0.30	0.15	-0.10	0.62	-0.30	0.14
SNB	-0.49	0.01	-0.30	0.15	-0.39	0.05
SNPog	-0.46	0.02	-0.34	0.10	-0.48	0.01
Extra-cranial	**OPT.HOR**		**CVT.HOR**		**OPT.CVT**	
A.Ver/N.Ver	-0.19	0.4	0.47	0.0	-0.14	0.5
B.Ver/N.Ver	-0.30	0.138	0.23	0.27	-0.31	0.128
Pog.Ver/N.Ver	-0.25	0.226	0.15	0.49	-0.24	0.246