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Determination of cervical posture and head posture with respect to sagittal jaw position: A Cephalometric Study

[1]Dr. Gauri Khade, [2]Dr. Manish Agrawal, [3]Dr. JiwanAsha Agrawal, [4]Dr. Sangmesh Fulari, [5]Dr.Shraddha Shetti, [6]Dr. Amol Shirkande

[1-6]Department of Orthodontics & Dentofacial Orthopaedics, Bharati Vidyapeeth (Deemed to be) Dental College And Hospital, Sangli.

Corresponding Author: Dr. Gauri Khade, Department of Orthodontics & Dentofacial Orthopaedics, Bharati Vidyapeeth (Deemed to be) Dental College And Hospital, Sangli.

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Abstract

Aim: The study was conducted to determine cervical posture and head posture in different skeletal sagittal malocclusions.

Materials and Methods: Cervical curvature and inclination of 51 subjects were assessed using their lateral cephalometric radiographs. Head posture was assessed using SN/ver, SN/OPT and SN/CVT. Cervical inclination was assessed using the cervico-horizontal postural variables namely OPT/HOR and CVT/HOR whereas cervical curvature was determined by measuring the angle OPT/CVT. 51 subjects were also categorized into skeletal Class I, II, and III ,17subjects in each group based on the ANB angle. Cervical column curvature was measured and related to sagittal jaw positions using statistical analysis consisting of descriptive statistics and intergroup comparison to find the level of significance for each parameter. The statistical analysis of data was carried with the help of means, ranges and standard deviations. Inter group mean values were compared and Student's t-test was used to test the difference between means of various variables.

Result: SN- Ver is significantly increased in skeletal class I, indicating an upward & backward tilting of head. Craniocervical angle (SN-CVT and SN-OPT) are significantly increased in skeletal class II, suggesting an upward and backward rotation of head and backward flexion of cervical column. Craniohorizontal angle (OPT-Hor and CVT-Hor) are singnificantally increased in skeletal Class III .This suggests that a more straight cervical column in skeletal Class III patients.Modified cervical angle (MCV) is increased in skeletal class II, indicating increased curvature of cervical column as compared to Class I and Class III malocclusion.

Conclusion: Modified craniocervical angle and craniovertical angle can be used to assess the relationship

between head posture, cervical column curvature and sagittal jaw position.

Keywords: MCV, OPT/HOR, CVT/ HOR

Introduction

Recent years have witnessed a renewed interest in the interaction between the form and function of the craniofacial region. Schwartz suggested a relationship between head posture and craniofacial morphology in 1928 and attributed the development of Class II malocclusion to hyperextension of the head relative to the cervical column during sleep. [1] The head and cervical traits of the vertebral column are part of a functional biomechanical unit, the cranial cervical mandibular system. [2]

Maxillo-mandibular relationship largely determines the facial profile of a patient. Hence, in orthodontics, studying skeletal vertical morphology as well as sagittal relations between the two jaws with reference to the cranial base forms an integral part of diagnosis and treatment planning. Cervical posture has previously been related to vertical craniofacial morphology. The upper and lower parts of the cervical column are said to differ in their origin of development. Graber suggested that the anatomy and position of the upper cervical vertebrae were closely linked with craniofacial development whereas the remaining cervical vertebrae developed in conjunction with the rest of the vertebral column. [3]

The importance of the understanding association between head posture and type of malocclusion is also extremely important when planning to correct skeletal discrepancy by ortho-surgical approach. Orthognathic surgery to advance or retract the mandible will change the center of gravity of the head and the spatial relationships of the suprahyoid cranial structures, both of which have been associated with changes in head posture. [4] Considering the importance of head posture and cervical posture in Orthodontic treatment planning and the lack of availability of many studies to support the association, it was decided to conduct this study to determine cervical posture and head posture in different skeletal sagittal malocclusions as well as to assess whether a correlation existed between cervical posture and head posture with a sagittal jaw position.

Materials and Methods

The study was carried out on the patients received in the Out-Patient Department of the Department of Orthodontics & Dentofacial Orthopaedics, Bharati vidyapeeth Dental College & Hospital, Sangli. The sample for this study consisted of 51 subjects which included 25 males and 26 females.

The 51 subjects were divided into three groups; 17 sample in each group, Group 1: Skeletal class I, Group 2: Skeletal class II malocclusion; Group 3: Skeletal class III .Those subjects between the age group of 18-25 years, who did not undergo any prior orthodontic treatment and had a full complement of permanent teeth up to 2nd molars were selected for the study. Individuals with any missing teeth, craniofacial anomalies, systemic disorders, temporomandibular joint disturbances, or subjects with upper airway obstruction were excluded`.

Cephalometric Radiographs

Lateral cephalometric radiographs were taken in the natural head position with the teeth in occlusion. The natural head position of the patient was determined by positioning the patient in the cephalostat and adjusting the head using the mirror position. The mirror position was defined by instructing the patient to look in his own eyes, in a mirror set at eye-level opposite to the cephalostat. This ensured a standardized technique for recording the subjects' natural head and cervical column position. To ensure consistent magnification, all radiographs were made upon a standardized lateral radiograph (18 × 24 cm film, Kodak, Germany) with a patient midplane-X ray

source distance of 146 cm, patient midplane-film distance of 13.5 cm and enlargement factor of 1% by a single technician in our radiology department.

Cephalometric Measurements

A) For assessment sagittal jaw relationship with reference to the cranial base:

1. ANB: This represents the difference between SNA & SNB angles [5] and determines the anteroposterior relationship of the maxillary and mandibular bases.

B) For assessment of cervical curvature:

Definition of reference points:

1. **Cv2tg:** Point most superior and posterior of the odontoid body [6].
2. **Cv2ip:** Point most posterior and inferior of the odontoid body [6].
3. **Cv4ip:** Point most posterior and inferior of C4 [6].

Definition of reference planes:

1. **Ver:** True vertical
2. **Hor:** True horizontal
3. **SN plane:** Plane formed by joining point sella and point nasion.
4. **OPT plane:** Plane formed by joining Cv2tg and Cv2ip
5. **CVT plane:** Plane formed by joining Cv2tg and Cv4ip

Definition of angular parameters:

1. **SN- Ver:** Angle between Sella Nasion plane and true vertical. Inferior and external angle [6].
2. **OPT- Hor:** Angle between OPT plane and true horizontal [6].
3. **CVT-Hor:** Angle between CVT plane and true horizontal [6].
4. **MCA:** Angle between CVT plane and OPT plane [6].

B) For assessment of Head Posture:

1. SN – VER: Angle between Sella Nasion plane and true vertical.
2. SN- OPT: Angle between OPT plane and sella Nasion Plane.
3. SN- CVT: Angle between CVT plane and Sella Nasion Plane.

Statistical Analysis

The statistical analysis of data was carried with the help of means, ranges and standard deviations. Inter group mean values were compared and Student's t-test was used to test the difference between means of various variables. In the statistical evaluation, the following levels of significance were used.

P>0.05 Non-significant

0.05 ≥ P>0.01* Significant

0.01 ≥ P>0.001** Highly significant

P ≤ 0.001*** Very highly significant

Results

Group wise comparison of all the variables was done in order to find whether the difference was statistically significant or not as seen in table 2, table 3 and table 4. It was seen that difference between SN-Ver was statistically significant in all the three groups. Also statistically significant differences were observed between variable MCA in all the groups. SN-CVT was found to have significant difference in group 3 .SN-OPT was found to have significant difference in group 1. OPT-Hor was found to have significant difference in group 2. CVT-Hor was found to have significant difference in group 3.

Descriptive statistics for each variable was calculated as seen in table 1.

Variable	Group 1		Group 2		Group 3	
	Mean	SD	Mean	SD	Mean	SD
ANB	2.47	0.94	6.82	1.55	-3.47	2.65
SN/Vert.	83.71	5.30	80.53	5.55	81.35	5.48
SN/CVT	117.18	5.29	119.18	6.05	114.00	9.21
SN/OPT	99.88	7.22	105.85	9.77	105.82	12.00
OPT/Hor.	82.00	7.57	79.18	7.55	83.94	4.88

CVT/Hor.	82.24	7.43	83.65	8.25	85.24	4.74
MCV	1.06	0.75	5.00	1.58	2.71	1.16

Table 1: Descriptive statistics including mean and standard deviation for all variables in three groups

Discussion

In this study craniovertical angle (SN- Ver) was found to be maximum in group 1 and least in group 2, suggesting an upward & backward tilting of head in skeletal class I. Craniocervical angle (SN-CVT and SN-OPT) was found to be maximum in group 2 and least in group 3, suggesting an upward and backward rotation of head and backward flexion of cervical column.

Also OPT-Hor angle (inclination of superior part of cervical column) was found to be associated significantly with sagittal position of the jaws with highest value for group 3 and lowest in group 2. The angle CVT-Hor (inclination of middle part of cervical column) was also found to be greatest in group 3 and lowest in group 1. This suggests that a more straight cervical column in skeletal Class III patients. Modified cervical angle [7] is used to determine curvature of cervical column in this study. This angle was chosen as it has a close relation with cervical curvature and can be measured easily. Highest value was found to be in group 2 suggesting that Class II malocclusion was associated with increased curvature of cervical column as compared to Class I and Class III malocclusion.

Conclusion

The following can be concluded with this study performed on 51 subjects (divided into 3 groups: 17 in each group) to access variation in head posture & cervical posture with sagittal jaw relation:

1) SN- Ver is significantly increased in skeletal class I, indicating an upward & backward tilting of head.
2) Craniocervical angle (SN-CVT and SN-OPT) are significantly increased in skeletal class II, suggesting an upward and backward rotation of head and backward flexion of cervical column.
3) Craniohorizontal angle (OPT-Hor and CVT-Hor) are singnificantally increased in skeletal Class III .This suggests that a more straight cervical column in skeletal Class III patients.
4) Modified cervical angle (MCV) is increased in skeletal class II, indicating increased curvature of cervical column as compared to Class I and Class III malocclusion.

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