ORIGINAL ARTICLE

RELATIONSHIP BETWEEN HEAD POSTURE AND LOWER ARCH DENTAL CROWDING

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ABSTRACT

Objective of the study was to determine the relationships between head posture and lower arch crowding.

Hundred cases records(lateral cephalograms and casts) were used in this study. Fifty percent were females and fifty percent males. The cases were divided into two groups; crowded and non-crowded. Each group containing 50 cases. The head posture (craniocervical angles- NSL/CVT, NSL/OPT) were measured in the both groups. Data were analyzed using SPSS for Windows version 16.0. The postural variables were calculated as the mean and standard deviation. The independent Student's t-test was used to determine if significant head postural difference exists between the two groups(crowded and non-crowded). Statistical significance was set as $P < 0.05$.

Out of total 100 patients in which 50 were females and 50 were males. Fifty cases were crowded and 50 were non-crowded. Their age ranged from 12 to 20 years with a mean age 16±3.2. The mean value for craniocervical angles; NSL/OPT and NSL/CVT were 97.34 and 101.50 respectively in non – crowded group. While the mean value for craniocervical angles; NSL/OPT and NSL/CVT were 106.57 and 111.40 respectively in crowded group. The difference in craniocervical angles (head posture) was statistically significant.

It was concluded that extended posture is associated with lower crowded cases.

Key Words: *Head posture , arch crowding, lateral cephalogram.*

INTRODUCTION

The cervical vertebral column supporting the head comprises seven vertebrae. The first vertebra (C1) or atlas and the second vertebra or axis together form the superior or suboccipital segment connecting the spine to the occiput and involving a complex chain of joints. Suboccipital muscles attached to this region determine head posture, controlling fine complicated movements for compound flexion and extension, as well as lateral flexion with rotation.[1,2] The cranial cervical mandibular system is made up of three main structures: TMJ, occipital atlas axis articulation, and hyoid bone with its suspensor system. These three structures are strictly working in coordination, but joined together with the rest of the body (vertebral column) by muscles and ligaments. Consequently, it is quite reasonable to expect that cervical posture can be related to craniofacial morphology[3,4] and nasorespiratory function.[5,6]

Extended craniocervical posture is frequently associated with an increase of anterior facial height, a decrease of sagittal jaw dimensions, and a steeper inclination of the mandible. When the head is flexed (in relation to the cervical column), anterior facial height is shorter, sagittal jaw dimensions are larger, and the mandibular plane is flatter.[7] Individuals with concave profile showed a tendency to bend the head downward, while people with a convex profile showed a tendency to bend the head upward.[4]

On the basis of significant correlation coefficients between postural and morphological variables, as well as significant differences among skeletal class I, class II, and class III groups, it was observed that greater craniocervical and craniovertical angles were related to lower lengths of the maxilla and mandible, greater maxillary and mandibular retrognathism, and a skeletal class II pattern.[8] Lower cervicohorizontal angles were related to maxillary and mandibular protrusion regarding measurements that considered extracranial reference lines and large sagittal interjaw discrepancy. One article reported facial prognathism in association with increased cervicovertical angles. Cervical spine was significantly straighter in skeletal class III patients and markedly curved in skeletal class II patients regarding the angle formed by the intersection of the cervical vertebra tangent and the lower segment of the cervical vertebra. Subjects with lower maxillary length were associated with a more lordotic cervical curve.[3,9]

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Dental crowding can be described either as a dentoalveolar discrepancy between available space (space present in dental arch) and the space needed (the space that is equivalent to sum of the mesial distal width of all of the teeth), or as lack of a correct dental alignment with anomalous dental inclination, position, or rotation. This occlusal condition has a multifactorial etiology and shows a wide incidence after eruption of the second permanent molar.[10]

AlKofide and AlNamankani11 reported that a relationship between crowding and head posture could only be found in subjects with upper arch crowding and cervical curvature and not with lower dental crowding (p<0.01). Solow and Sonnesen[6] showed a strong inverse correlation between internal craniocervical angles and dental crowding greater than 2 mm. In particular, subjects with dental crowding of more than 2 mm in the lower anterior segment of the dental arch had mean craniocervical angles 30 to 50 larger than subjects without crowding. Pachi et al[12] reported that Subjects with more than 2 mm dental crowding had mean craniocervical angles that were 50 to 60 larger than the subjects with the space conditions smaller than 2 mm (p<0.01). In addition, the mean craniohorizontal angles in the subjects with lower dental crowding were 40 smaller than subjects without dental crowding.

METHODOLOGY

This comparative, cross sectional study was in department of Orthodontics, Khyber College of Dentistry Peshawar. Approval of the hospital ethical committee will be taken. Cephalograms and casts of subjects fulfilling the inclusion criteria will be invited to take part in the study. The purpose, procedures, risk and benefits of the study will be explained to them. An informed consent and their willingness and participation in the study shall be ensured. They will be assured of maintaining confidentiality of their personal and other data collected from their records.

Sampling criteria are as follows:

Inclusion criteria

1. Having full permanent dentition
2. Age from 12 to 20 years
3. Pakistani nationals
4. Cephalograms of high clarity
5. Both genders

Exclusion criteria

1. Previous history of orthodontics treatment
2. TMJ disorders
3. Cervical spine disorders
4. Congenital anomalies
5. Interproximal caries in lower arch
6. Hormonal abnormalities e.g. gigantism and acromegaly.

All selected subjects were divided into two groups based on lower arch dental crowding as determined by Nance's space analysis.[13,14] The necessary space was calculated as the sum of the mesiodistal width of all teeth between the mesial contact points of the left and right second molar. A caliper positioned parallel to the long axis of the tooth was measured these widths. The available space, or real arch perimeter, will be calculated as the length of a brass wire modeled in relation to the individual shape of the lower arch, using the incisor margins and buccal cusps of the posterior teeth.

Space conditions had been calculated as the difference between available space and necessary space. Negative values showed a lack of space (crowding), while positive values (or value = 0) showed a well-aligned arch or excess of space in the arch to align correctly all teeth.

Lateral cephalometric radiograph of each individual was taken with a universal counter balancing type of cephalostat at Radiology Department of Khyber College of Dentistry Peshawar. Kodak' X-ray films (10 × 12) were exposed to 70 KVp, 10 mA for an average of 1.8 sec, with a tube to film distance of 6 feet. All lateral skull radiographs were taken by the same operator with the subjects standing with the head in the natural head position. The lateral radiographs showed the first four cervical vertebrae. The lateral cephalograms was traced on acetate paper on illuminator including four points in the craniofacial area and three points in the cervical column area. Craniocervical angles (NSL/CVT, NSL/OPT) were traced. (Reference points, reference lines and craniocervical angles are given in Table 1).

Data were analyzed using SPSS for Windows version 16.0. The postural variables were calculated as the mean and standard deviation. The independent Student's t-test was used to determine significant head postural difference between the two groups(crowded and non-crowded). Statistical significance was set as $P < 0.05$.

RESULTS

Out of total 100 patient in which 50 were females and 50 were males. Fifty cases were crowded and 50 were non-crowded. Their age ranged from 12 to 20 years with a mean age 16±3.2. The mean value for craniocervical angles; NSL/OPT and NSL/CVT were 97.34 and 101.50 respectively in non – crowded group. (Table 2). While the mean value for craniocervical angles; NSL/OPT and NSL/CVT were 106.57 and 111.40 respectively in crowded group. (Table 3). Table 4 shows the results of on sample t-test at significant level <0.05. The difference in craniocervical angles (head posture) is statistically significant.

DISCUSSION

Previous studies have found an association between malformations of the upper cervical vertebrae and patients with cleft lip and palate.[15] Recently, an association was also found between malformation of the upper cervical vertebrae not only in patients with condylar hypoplasia, but also in adult orthodontic surgical patients with skeletal deep bite, skeletal mandibular overjet,[6] skeletal horizontal overjet, and skeletal open bite.[16] These studies showed that cervical column deviations occurred in 72.7% of the condylarhypoplasia group, 41.5% of the deep-bite group, 61.4% of the mandibular-overjet group, 52.9% of the horizontal-overjet group, and 42.1% of the open-bite group. Deviations occurred significantly more often in all patient groups compared with the control group. This indicates that morphologic deviations of the upper cervical vertebrae are not only associated with malformation of the jaws but also with craniofacial morphology and occlusion.[15]

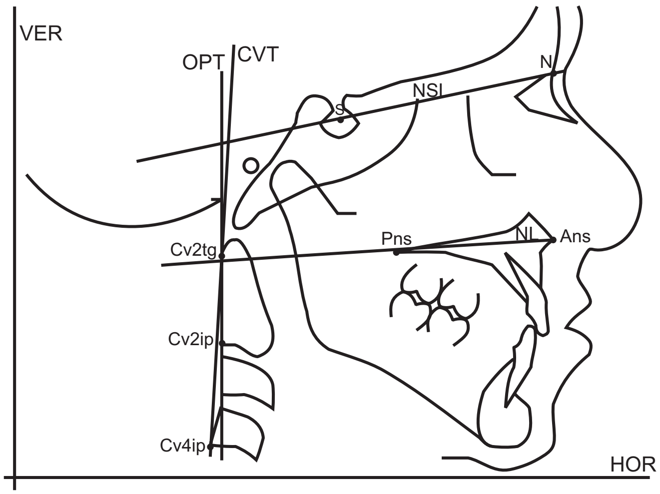

Fig 1: Craniocervical angle and reference points on lateral headfilms

Because of the conflicting findings of previous studies, is to investigate whether any significant relationship exists between head posture and lower arch crowding in Peshawar population. Many malocclusion types are associated with different head postures (extension or flexion). Extended craniocervical posture is frequently associated with an increase of anterior facial height, a decrease of sagittal jaw dimensions, and a steeper inclination of the mandible. When the head is flexed (in relation to the cervical column), anterior facial height is shorter, sagittal jaw dimensions are larger, and the mandibular plane is flatter. this study will be helpful to diagnose these problems (sagittal and vertical) from lower arch crowing (mixed dentition analysis) very early and can be managed.

In this study a statistically significant difference was found between crowded and non-crowded groups. In the present we taken into consideration only skeletal class I cases. Pachı et al12 conducted a study for relationship between the posture of the head and the neck and late lower arch crowding. The sample comprised 55 subjects (23 female, 32 male), age 12-18 years, with complete permanent dentition and without previous orthodontic treatment. The results showed that the differences of the postural variables between the two groups are statistically significant. Pachi's study supports the present results.

The association between head posture and lower arch crowding could also explain the reports of Linder-Aronson[17] and Woodside et al.[18] They showed that subjects with obstruction of the nasopharyngeal airway presented a greater irregularity index and reduced incisor inclinations relative to the subjects

TABLE 1: OPERATIONAL DEFINITIONS

Reference Points of the Cephalograms	Reference Lines of the Cephalograms	Craniocervical angles
Sella turcica(S) — The midpoint of sella turcica	**True vertical line (Ver)** — True vertical line projected on the film	**NSL/OPT** — Downward opening angles between NSL line and OPT line
Nasion(N) — The intersection of the internasal suture with nasofrontal suture in the midsagittal plane	**True horizontal line (Hor)** — True horizontal line projected on the film	**NSL/CVT** — Downward opening angles between NSL line
Anterior nasal spine(ANS) — Tip of the anterior nasal spine seen on the x-ray from the normal lateralis	**Cranial base Line (NSL)** — extending between Sella and Nasion	
Posterior nasal spine (PNS) — Tip of the posterior spine of the palatine bone in the hard palate	**Palatal plane Line (NL)** — extending between ANS and PNS	
Cv2tg — Tangent point of OPT line on the odontoid process of the second cervical vertebra	**Cervical vertebra tangent (CVT)** — Posterior tangent to the odontoid process through Cv4ip	
Cv2ip — The most inferior posterior point on the corpus of the second cervical vertebra	**Odontoid process tangent (OPT)** — Posterior tangent to the odontoid process through Cv2ip	
Cv4ip — The most inferior posterior point on the corpus of the fourth cervical vertebra		

TABLE 2: CRANIOCERVICAL ANGLES IN NON-CROWDED CASES (N=50)

Craniocervical angle	Mean	Median	Standard deviation
NSL/OPT	97.34	96	4.45
NSL/CVT	101.50	102	4.57

TABLE 3: CRANIOCERVICAL ANGLES IN CROWDED CASES (N=50)

Craniocervical angle	Mean	Median	Standard deviation
NSL/OPT	106.57	105	9.35
NSL/CVT	111.40	110	8.37

TABLE 4: RELATIONSHIP BETWEEN CROWDED AND NON-CROWDED CASES

Craniocervical angle	Mean difference	P-value*
NSL/OPT	4.90	0.01**
NSL/CVT	3.8	0.01**

*one sample test

**Significant level < 0.05

without nasal airway obstruction. Furthermore, they showed that after adenoidectomy, and with the return of nasal respiration, an increased inclination of the incisors resulted.

In the current study, the result showed that term hyperextension of the head posture is associated with lower arch crowding. This phenomena is explained by Solow and Kreiborg[19] that how the resting muscular activity depends on the head posture in relation to the vertebral column. In cases of long-term hyperextension of the head posture, these soft tissues stretch,creating a dorsal and caudal force against the teeth and skeleton. If this force is not balanced by an increase of tongue muscular activity, it can induce a dorsal and caudal restraint on facial development and a retroinclination of the incisors with a consequent loss of correct alignment. Normal head posture can induce relaxed soft tissues with consequent sagittal development and proclination of the incisors.

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CONTRIBUTION BY AUTHORS

1 **Syed Suleman Shah:** Topic selection, paper writing, data analysis.

2 **Ghulam Rasool:** Supervisor.

3 **Faiz-Ul-Hassan:** Data collection.