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Dentoalveolar heights in skeletal class I normodivergent facial patterns

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ORIGINAL ARTICLE

Dentoalveolar Heights in Skeletal Class I Normodivergent Facial Patterns

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ABSTRACT

Objective: To determine the dentoalveolar heights (mm) in skeletal class I normodivergent facial pattern and compare the same heights in male and female subjects.

Study Design: Cross-sectional observational study.

Place and Duration of Study: Orthodontics Clinic, The Aga Khan University Hospital, Karachi, from July to October 2009.

Methodology: Eighty one subjects were selected from the orthodontic record at the Aga Khan University Hospital Karachi. The inclusion criteria were an age range of 12 to 30 years and skeletal class I normodivergent facial pattern with exclusion criteria of prior orthodontic treatment, restored teeth and craniofacial anomalies/syndromes. The pre-treatment cephalographs of the patients were traced manually on acetate paper by the principal investigator. The various land marks were marked and the parameters were recorded. Mean and standard deviations were determined. Independent sample t-test was used to find gender dimorphism.

Results: The mean age of the sample was 15.8 ± 3.4 years. Mean ANB angle for the entire sample was 2.6° ± 1.2° and for angle SN-MP was 31.5° ± 2.5°. Descriptive analysis presented mean value of upper anterior, upper posterior, lower anterior and lower posterior dentoalveolar heights to be 28.5 ± 2.7 mm, 22.9 ± 2.6 mm, 41.3 ± 2.9 mm and 31.5 ± 3.2 mm respectively. Male subjects had significantly greater mean values for lower anterior and posterior dentoalveolar heights (p=0.02 and 0.05 respectively).

Conclusion: The mean dentoalveolar heights for the skeletal class I normodivergent sample were established. No gender dimorphism was found for upper dentoalveolar heights however, lower anterior and lower posterior were significantly greater in males as compared to females. All the values of dentoalveolar heights for male subjects were greater than female subjects.

Key words: *Dentoalveolar heights. Skeletal class I. Normodivergent.*

INTRODUCTION

The dentoalveolar segment develops with the eruption of teeth and comprises of teeth and the surrounding alveolar bone.[1] When the teeth of the opposing jaws come in contact with each other they establish the dentoalveolar heights. Thereafter the dental contact is maintained despite the continuous growth of the underlying skeleton.[2] So this is an important issue whereby teeth maintain their contact and the skeletal bases deviate from their normal relation with each other and as a result effect the position of teeth in the jaws. The changes in the dentoalveolar height may either be the cause or the manifestation of the underlying skeletal malocclusions.[3] For this reason the dentoalveolar heights have been investigated by the researchers in relation to the overbite, overjet, long face syndrome, short face syndrome, vertical maxillary excess and deficiency.[4-9]

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The findings of these studies are variable and on many occasions contradictory.[4-9] Several investigators reported no difference in incisor and molar heights in long or short faces when compared to normal faces.[10-12] According to Betzenberger *et al.* the maxillary and mandibular posterior dentoalveolar heights are decreased in high-angle malocclusion.[13] On the contrary, other investigators reported that maxillary and mandibular incisor and molars heights are greater in long faces as compared to the normal faces.[6,8,12] Subtenly and Sakuda reported that maxillary dentoalveolar heights are greater in long faces as compared to normal faces however, they found no significant difference in the mandibular dentoalveolar heights between the two groups.[14] Opdebeek and Bell found that the dentoalveolar heights in subjects with short faces to be less than the subjects with normal faces.[7]

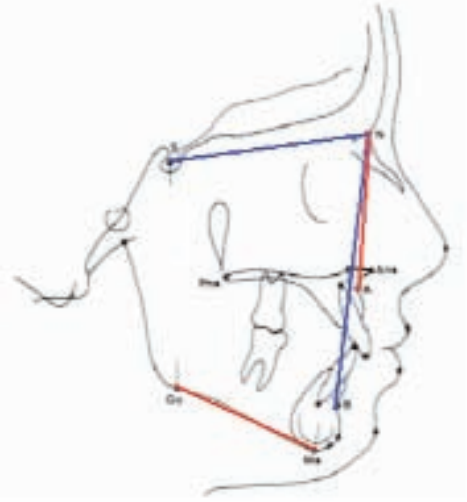
This overwhelming contrast in the results of the studies may be due to the different sample selection criteria but the role of genetic and environmental factors cannot be ignored. Another important factor to be considered is that the studies carried out at different population of discrete origin come up with variable results. The different populations have specific facial features and norms of aesthetic values.[1,15] The mean value of dentoalveolar heights for each population is an important

factor in orthodontic treatment. Settling the teeth at their normal height during orthodontic treatment ensure stability of the treatment results and produces harmony between the dental and skeletal components.[1] The aim of this study is to establish mean values of dentoalveolar heights and gender dimorphism in subjects of Pakistani origin. Therefore, this study was carried out on subjects with skeletal class I normodivergent facial pattern in order to rule out any confounding effects of sagittal and vertical skeletal component on the dentoalveolar heights (DAH).

METHODOLOGY

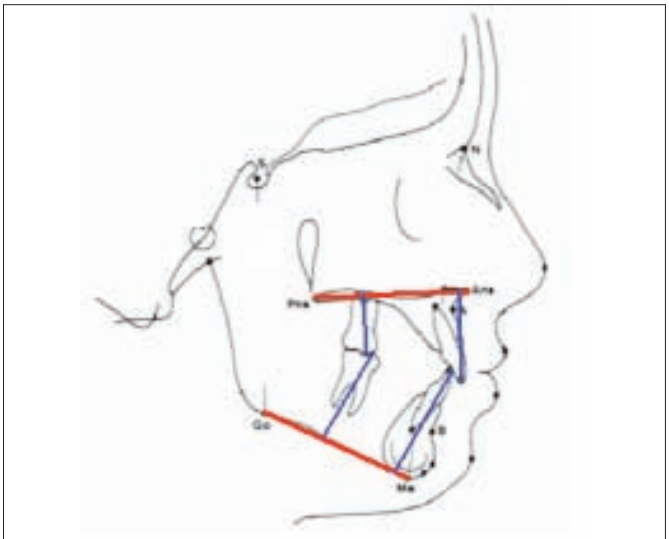
This was a cross-sectional study carried out at Orthodontic Department, the Aga Khan University Hospital, Karachi, from July to October 2009. The record of 81 subjects were selected from the orthodontic record of the department. The inclusion criteria were an age range of 12 to 30 years, fully erupted incisors and first molars and skeletal class I normodivergent facial pattern. The exclusion criteria were prior orthodontic treatment, restored teeth and craniofacial anomalies/ syndromes. The age of each subject was recorded from the orthodontic record file. The pre-treatment cephalographs of the subjects were traced manually on acetate paper by the principal investigator. Figure 1 shows various land marks and angular measurements that were drawn and recorded on the cephalometric tracing for each subject. The faces were skeletal class I with an angle ANB of 2° ± 2° and normodivergent with angle SN-MP of 32° ± 4°.[17] The dentoalveolar heights are shown in Figure 2. The upper anterior dentoalveolar height (UADH) was recorded as the perpendicular distance (mm) from the tip of the maxillary central incisor to the palatal plane. The upper posterior dentoalveolar height (UPDH) was recorded as the perpendicular distance (mm) from the tip of the maxillary first permanent molar to the palatal plane. The lower anterior dentoalveolar height (LADH) was recorded as the perpendicular distance (mm) from the mandibular permanent central incisor to the mandibular plane. The lower posterior dentoalveolar height (LPDH) was recorded as the perpendicular distance (mm) from the tip of the mesiobuccal cusp of mandibular first permanent molar to the mandibular plane.[14]

The data was analyzed using Statistical Package for Social Sciences (SPSS) for windows (version 16, Inc; Chicago). Means and standard deviation for all variables were established for the entire sample and for both the genders. Independent sample 't' test was used to determine gender difference of the dentoalveolar



Angle ANB: The angle formed by point A, point B and Nasion.
Angle SN-MP: The angle formed between S-N plane and mandibular plane
Sella (S): Geometric center of the pituitary fossa located by visual inspection.
Nasion (N): Located on the most anterior aspect of the frontonasal suture in the midsagittal plane.
Point A (A): The most posterior point in the concavity between the anterior nasal spine and prosthion (the most inferior point on the alveolar bone overlying the maxillary incisor).
Point B (B): The most posterior point in the concavity of the mandible between the most superior point on the alveolar bone overlying the mandibular incisor (infradentale) and pogonion.
Menton (Me): The most inferior point on the mandibular symphysis.
Gonion (Go): A point on the curvature of the mandible located by bisecting the angle formed by lines tangent to the posterior ramus and the inferior border of the mandible.
Anterior Nasal Spine (ANS): Anterior tip of the sharp bony process of the maxilla at the lower margin of the anterior nasal opening.
Posterior Nasal Spine (PNS): The posterior spine of the palatine bone constituting the hard palate
S-N Plane: The plane formed by joining Sella and Nasion points.
Mandibular Plane (M-P): The plane formed by joining Gonion and Menton.
Palatal plane: The plane formed by joining the points ANS and PNS.

Figure 1: Cephalometric landmarks, angle ANB and angle SN-MP.



UADH: The perpendicular line drawn from the maxillary incisor tip to palatal plane.
UPDH: The perpendicular line drawn from the mesiobuccal cusp tip of maxillary first permanent molar to palatal plane.
LADH: The perpendicular line drawn from the mandibular incisor tip to mandibular plane.
LPDH: The perpendicular line drawn from the mesiobuccal cusp tip of mandibular permanent first molar to mandibular plane.

Figure 2: Cephalometric landmarks, angle ANB and angle SN-MP.

Table I: Mean values of age, ANB, SN-MP and dentoalveolar heights for whole sample (n = 81).

Variable	Mean ±S.D
Age	15.8 ± 3.4 years
ANB	2.6° ± 1.2°
SN-MP	31.5° ± 2.5°
UADH	28.5 ± 2.7
UPDH	22.9 ± 2.6
LADH	41.3 ± 2.9
LPDH	31.5 ± 3.1

Table II: Gender dimorphism of age, angles ANB and SN-MP and dentoalveolar heights (n = 81).

Variable	Male (n = 27) Mean ± S.D	Female (n = 54) Mean ± S.D	p-value
Age	15.4 ± 3.9	16.1 ± 3.6 years	0.49
ANB	2.6° ± 1.2°	2.6° ± 1.2°	0.95
SN-MP	31.6° ± 2.7°	31.4° ± 2.4°	0.76
UADH	28.9 ± 2.3	28.2 ± 2.8	0.27
UPDH	23.1 ± 3.1	22.8 ± 2.4	0.59
LADH	42.3 ± 3.2	40.7 ± 2.7	0.02*
LPDH	32.5 ± 3.5	31.1 ± 2.9	0.05*

*Independent sample t-test; Level of significance 0.05 **

heights. The p-value of ≤ 0.05 was taken to be statistically significant.

RESULTS

The sample of 81 subjects comprised of 27 males (33.33%) and 54 females (66.67%). Table I shows the values of age, angle ANB, angle SN-MP and dentoalveolar heights for the whole sample. The mean age of the sample was 15.8 ± 3.4 years, the angle ANB was 2.6° ± 1.2° and angle SN-MP was 31.5° ± 2.7°. The mean values of DAH. The UADH, UPDH, LADH and LPDH were 28.5 ± 2.7 mm, 22.9 ± 2.6 mm, 41.3 ± 2.9 mm and 31.5 ± 3.1 mm respectively. The mandibular DAH were greater than maxillary DAH. The highest value was that of the LADH and the lowest values were displayed by UPDH.

Table II shows the comparison of values for the age, angle ANB, angle SN-MP and dentoalveolar heights of the male and female subjects. There was no significant difference between the male and female subjects regarding the variables of age, angle ANB and angle SN-MP. All the values of DAH were greater in male subjects as compared to female subjects. More importantly the values of the LADH (p = 0.02) and LPDH (p = 0.05) were significantly greater in males than in females.

DISCUSSION

The DAH in orthodontic literature has been the focus of concern for many researchers. These researchers studied the DAH in relation to various malocclusions and utilized different selection criteria for their sample. These studies show results which are variable because the sample belonged to populations of different origin and the criteria which they utilized for sample selection. This study was carried out to establish normal values of DAH. For this reason the DAH was evaluated in subject with skeletal class I normodivergent facial pattern which is considered ideal.

The values of DAH in this study when compared with other studies also show variable results for both the male and female subjects.[13,16,18-21] However, it must be noted that the finding in this study cannot be directly compared to other studies because this study exclusively presents the DAH in skeletal class I normodivergent facial patterns while other look into the matter from other dimensions. What could be done was to determine and compare all those values which they have presented for either skeletal class I or normodivergent facial patterns.

Janson *et al.* studied the relation of dentoalveolar heights in subjects with normal, long and short faces.[18] They also compared the DAH in skeletal class I and skeletal class II facial patterns. Their results showed that subjects with skeletal class I and normodivergent facial pattern have DAH mean values less than that given in this study except for UADH in male subjects which showed slightly greater values. The difference in results may be due to the selection of subject for which Janson *et al.* have used lower anterior face height ratio to group, the subjects in to normal, short and long faces.[18] However, in author opinion the difference in results due to separate origin of population cannot be ruled out. Another study carried out at Burlington growth centre has also presented the mean values of DAH.[19] The results of their studies also show that DAH in this study are greater than their findings with similar result for UADH which is less than the mean value presented in the Burlington study.

The results did not always hold the same for the similar population group, as another study presented values for the DAH which were variable for male and female subjects when compared to the mean values in this study.[20] Their results showed that DAH for male subjects were greater than the values presented in this study. However, the mean values for female subjects in this study showed that all the DAH were greater than their results except LADH which showed a decrease in values.

Dentoalveolar heights of male subjects were larger than the corresponding heights of female subjects. These gender differences in dentoalveolar heights, males having greater values as compared to females, have been also reported in other studies.[22,23] A recent study on subject of French-Canadian origin,[23] showed dentoalveolar heights to be significantly decreased than the values presented in this study. However, their results

also confirmed that the male subjects have greater dentoalveolar heights than the female subjects. Dentoalveolar heights were probably greater in male subjects because they undergo more vertical growth and have larger teeth than female subjects.[24]

Exploring the relationship of molar DAH with craniofacial heights Martina *et al.* found that DAH were positively affected by the changes in the lower anterior facial height.[16] Important to mention were all those values of sample size, angle ANB and angle SN-MP which closely resembled this study. This means that their subjects were also predominantly skeletal class I normodivergent in facial pattern. However, the molar DAH were different and suggested greater values for UPDH and decreased values for LPDH. Yet another study by Isaacson and Speidel showed that the subjects were also skeletal class I normodivergent in facial pattern.[21] Their results for DAH as compare to this study were decreased except for the UADH which were almost the same. These results strengthen the author's opinion about the relation of DAH to population of discrete origin.

Betzenberger *et al.* assessed the compensatory mechanism of DAH in the high angle individuals of central European origin.[13] The results were interesting as the subjects in mixed dentition presented with decreased DAH than the subjects with permanent dentition which were comparable to DAH presented in present study. However, all the subjects were hyper-divergent in contrast to the normodivergent subjects representing the sample of this study. Although the increases in DAH have been found in relation to the hyperdivergent facial pattern in several studies,[6,8,21] the results presented by Betzenberger *et al.* were not in agreement with them.[13]

From the discussion above it has been revealed that DAH could be found in a number of combinations with the underlying skeletal morphology. For these reasons the normal values for DAH must be established for each population group in order to address the malocclusion with proper guidelines in hand. As some of the values of DAH considered higher/lower for one population, may be quite normal for the other.

CONCLUSION

DAH is an important factor to be considered when treating a malocclusion orthodontically. As the DAH shows variable values for different population groups, therefore, for this reason the normal values of DAH must be known. The DAH for subjects with skeletal class I normodivergent facial pattern in this study have been established. All the values for male subjects were greater than female subjects. The LADH and LPDH have statistically significant greater values in male subject as compared to female subjects.

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