Original Article

Assessment of Relation of Orofacial Structures with Pharynx among Males and Females: A Lateral Cephalometric Study

Abstract

Aim: This study aimed to determine the correlation between orofacial structure and oropharyngeal airway space. **Materials and Methods:** It comprised of 160 individuals aged 14–24 years (males: 80 and females: 80), in which digital lateral cephalograms were taken. Linear and cephalometric analyses were performed in all cases. **Results:** Ba–PNS, apw2–ppw2, hy–apw2, distance between tongue and posterior pharyngeal wall (t–ppw), and Hormion perpendicular and anterior nasal spine-posterior nasal spine (ANS-PNS) showed significant difference between males and females ($P < 0.05$). Other distances such as Ba–ad1, Ba–ad2, Ptm–ad1, Ptm–ad2, PNS–ppw1, and apw4–ppw4 were statistically nonsignificant ($P > 0.05$). **Conclusion:** Linear and cephalometric measurements showed that Ba–PNS, t–ppw, Hy–ppw2, distance between Ho perpendicular and ANS-PNS plane, and apw2–ppw2 were higher in males as compared to females. Lateral cephalograms are useful in orthodontics in performing tracings in individuals with a potential risk of malocclusion.

Keywords: *Cephalometric, linear, orthodontics*

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Introduction

Nasopharynx, hypopharynx, and oropharynx are the components of pharyngeal airway space. It is made up of more than twenty muscles and is greatly affected by developing craniofacial skeleton. Both nasopharynx and oropharynx play an important role in breathing and swallowing. The nasopharynx is one of the components of respiratory system which lies posterior to nasal cavity and superior to soft palate.[1]

As it moves downward, it continues with oropharynx in the posterior part. Studies have depicted a strong association of dentofacial structures and pharynx. Any variation in oropharyngeal airway space may show its effect on dental or skeleton component.[2] Malocclusion is common in patients with abnormal oropharyngeal airway space. There can be disturbances in breathing as a result of variation in nasopharyngeal space. Conditions such as obstructive sleep apnea may be the result of it. Skeletal sagittal relation, maxillary protrusion, and posture of head may affect the airway space. Extensive research has been published regarding skeletal sagittal relation with oropharyngeal airway space.[3]

Careful assessment of pharyngeal airway space helps in the determination of skeleton malocclusion. This is very useful in patients who are at risk of developing malocclusion. Cephalometric evaluation of upper airway space is of paramount importance in patients with skeleton Class II or Class III malocclusion. Thus, a correlation between craniofacial morphology and oropharyngeal airway space exists.[4] Considering this, the present study was conducted with an aim of determining the correlation between orofacial structure and oropharyngeal airway space.

Materials and Methods

The present study was conducted in the department of orthodontics. It comprised of 160 individuals in the age range of 14–24 years (males: 80 and females: 80) of both genders. The purpose of the study was explained to all participants and written consent was obtained. Ethical clearance was taken from the institutional Ethical Committee.

Participants with Class I molar relation, nasal breathing, without asymmetry of facial component, and presence of all permanent teeth from central incisors to

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second molars were selected for the study. Individuals with previous orthodontic treatment, with hearing and visual abnormalities, facial asymmetry, and overjet and overbite >4 mm were excluded from the study. In all participants, lateral cephalogram was obtained with digital planmica machine operating at 30 mA and 70 kVp. The participants were asked to be straight with Frankfurt horizontal plane parallel to the floor and mid-sagittal plane perpendicular to the floor. Teeth were in maximum intercuspation, and a cassette was kept at the distance of 5 ft from the patient.

The airway areas of the nasopharynx and oropharynx were calculated separately. The following landmarks on lateral cephalogram were measured. Ptm: it is known as pterygomaxillary point. It is the inferior most point of the right and left outlines of pterygomaxillary fissure. ANS is the anterior nasal spine and the tip was considered in the study. PNS is the posterior nasal spine and the tip was measured. Cv3ia is the most infero-anterior point on the body of the third cervical vertebra. hy is a hyoid bone, and the most anterior and superior point on the body of hyoid bone was measured [Figure 1].

The Ptm vertical was used as the anterior border of the nasopharyngeal airway. The ANS-PNS plane was considered as the lower border. The ANS-PNS plane was the upper border of oropharyngeal air passage and the hy-cv3ia line was the lower borders of oropharyngeal air passage. All calculations were done on digital lateral cephalogram [Figure 2]. To avoid errors, two specialists in orthodontics did the calculations and the mean of their findings was considered the final value. Results thus obtained were subjected to statistical analysis using Chi-square test. $P < 0.05$ was considered statistically significant.

Results

Table 1 shows that Ba–PNS, apw2–ppw2, distance between hyoid and anterior pharyngeal wall 2 (hy–apw2), distance between tongue and posterior pharyngeal wall (t–ppw), and Hormion perpendicular and ANS-PNS showed significant difference between males and females ($P < 0.05$).

Discussion

Malocclusion is one of the main complaints of patients for which they seek dental consultation. Among various types of malocclusion, the most common is Class II followed by Class I and Class III. It is further divided into dental and skeleton malocclusion. Skeleton malocclusion type II is characterized by maxillary bone protrusion and subsequently mandibular retrusion. In this abnormality, maxilla is forwardly placed as compared to mandible leading to unesthetic appearance.[5] In the present study, we assessed different pharyngeal parameters among males and females using lateral cephalogram in the study population.

In the present study, we included 160 individuals aged 14–24 years. All were subjected to lateral cephalogram and the following points were measured: midpoint of sella turcica, basion which is the lowermost point on foramen magnum, Ptm, Hormion which is the inferior most point of spheno-occipital synchondrosis, tip of ANS and PNS, dorsal tongue surface, posterior pharyngeal wall, posterior pharyngeal wall intersecting at ANS-PNS point, supero-anterior point of hyoid bone, point on the second and third cervical vertebra and hyoid bone, and anterior pharyngeal wall intersecting point on the body of the second and third cervical vertebra and hyoid bone.

Subtelny[6] in their study found that in females, nasopharyngeal airway space remains stable starting from infancy till they develop maturity, whereas in males, variation may be seen in different age groups.

In the present study, we found that Basion–PNS distance which depicts the depth of nasopharynx was significantly higher in males as compared to females. Similarly, apw2–ppw2 distance between anterior pharyngeal wall and posterior pharyngeal wall (upper depth of oropharynx) was

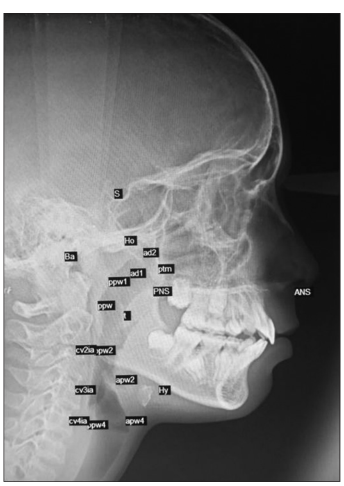

Figure 1: Cephalometric landmarks on lateral cephalogram

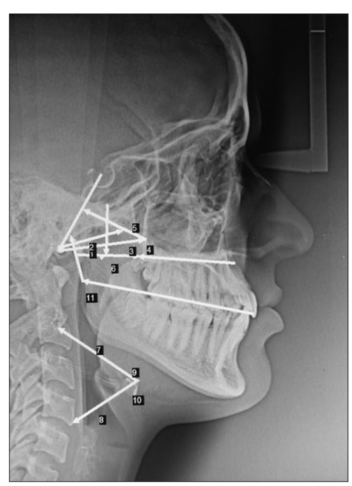

Figure 2: Linear measurements on lateral cephalogram

Table 1: Pharyngeal parameters on lateral cephalogram in all patients

Parameters (mm)	Male		Female		P
	Mean	SD	Mean	SD	
Ba-ad1 distance	22.26	3.61	21.34	3.60	0.5
Ba-ad2 distance	38.20	3.86	37.51	3.87	0.1
Ba-PNS distance	53.08	3.68	48.12	3.48	0.01
Ptm-ad1 distance	22.46	2.58	21.32	2.42	0.4
Ptm-ad2 distance	14.20	3.26	13.90	2.75	0.1
PNS-ppw1 distance	26.76	4.22	25.87	4.02	0.9
apw2-ppw2 distance	15.32	3.53	14.30	3.18	0.02
apw4-ppw4 distance	16.45	3.64	15.78	2.67	0.3
Hy-apw2 distance	25.33	5.23	20.46	3.78	0.05
Hy-apw4 distance	22.89	3.25	19.74	2.15	0.4
t-ppw distance	21.56	2.35	18.68	2.65	0.01
Distance between Ho perpendicular and ANS- PNS plane	22.56	2.56	19.80	2.11	0.02

SD: Standard deviation

higher in males as compared to females. We found that hy–apw2, t–ppw, and distance between Ho perpendicular and ANS-PNS plane showed significant difference between males and females ($P < 0.05$). Ceylan and Oktay[7] in their study assessed pharyngeal size between males and females and found that t–ppw and hy–apw2 were significantly higher in males as compared to females.

Malkoc *et al*.[8] analyzed different positions of hyoid bone and tongue with the help of lateral cephalogram and suggested that lateral cephalograms are useful diagnostic tool in determining airway dimensions. Aboudara *et al*.[9] in their study suggested that developments of craniofacial structures are strongly affected by changes in the way of nasal breathing. The authors used conventional lateral headfilms and compared it with cone-beam computed tomography in 35 individuals which included 27 girls and 8 boys of 14 years of age and found that both are effective in assessing enlarged adenoid masses. As an orthodontist, the prime most duty is to carefully examine the cases clinically as well as radiographically.

Gabrielli *et al*.[10] evaluated upper airway space with the help of lateral cephalogram in patients with Class III malocclusion. The study comprised of ten adults in the age range of 26–55 years. The authors concluded that airway may not be affected by slight maxillary or mandibular advancement. Hence, careful airway assessment is important in cases suspecting of malocclusion.

In the present study, we found that Ba–ad1 distance was 22.26 mm in males and 21.34 mm in females, Ba–ad2 distance was 38.20 mm in males and 37.51 mm in females, Ptm–ad1 distance was 22.46 mm in males and 21.32 mm in females, and Ptm–ad2 distance was 14.20 mm in males and 13.90 mm in females. Although the values were higher in males, there was no statistically significant difference between males and females. Similarly, PNS–ppw1 distance, apw4–ppw4 distance, and Hy–apw4 distance were nonsignificant among males and females. Sprenger *et al*.[11] in their study evaluated hypopharyngeal, oropharyngeal, and nasopharyngeal airway space and found that in oropharynx region, posterior-palatal space measurement was decreased in individuals with a dolichofacial pattern. A total of 28 points were considered with the help of tweed cephalometry angular measurements such as FMA and Y-axis.

Rosa and Braga[12] in their study assessed mandibular skeletal Class II malocclusion patients and upper airway space was measured in all the eighty cases. The authors found that in patients with mandibular skeletal Class II malocclusion, the upper airway space, mandibular length, and position are reduced. Joseph *et al*.[13] in their study determined airway space with the help of lateral cephalogram in patients with normodivergent and hyperdivergent facial pattern. The authors found that nasopharyngeal airway is smaller in patients with hyperdivergent facial pattern as compared to patients with normodivergent facial pattern.

Popovich and Thompson[14] concluded that airway spaces are strongly affected by different craniofacial structures. Dentofacial structures which are found in approximation with pharynx may affect it. The chances of interaction between both cannot be overlooked. The results obtained in our study are in agreement with the results of Aggarwal *et al*.[15] Authors in their cross-sectional study assessed the correlation of orofacial structures with oropharynx in 180 patients with the help of lateral cephalogram. Measurements such as Ba–PNS, t–ppw, and apw2–ppw2 were higher in males as compared to females.

Conclusion

Linear and cephalometric measurements showed that Ba–PNS, t–ppw, Hy–ppw2, and distance between Ho perpendicular and ANS-PNS plane and apw2–ppw2 were higher in males as compared to females. Careful assessment of airway space may provide useful information regarding potential malocclusion. Lateral cephalogram is a boon to orthodontics in performing tracings and thus be used in assessing the risk of malocclusion.

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Conflicts of interest

There are no conflicts of interest.

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