ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 11, Issue, 02, pp.1329-1333, February, 2019

DOI: https://doi.org/10.24941/ijcr.34215.02.2019

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

ASSESSMENT OF CHANGE IN MEAN AREA OF NASOPHARYNX, HYOID TRIANGLE AND POSITION OF HYOID BONE AFTER FUNCTIONAL APPLIANCE THERAPY

Narayana Prasad, P., Tarun Kumar, Tarun Sharma, *Anupa Rawat and Mansi Rawat

Department of Orthodontics and Dentofacial Orthopaedics, Seema Dental College and Hospital, Rishikesh, Uttarakhand, India

ARTICLE INFO

Article History:
Received 20th November, 2018
Received in revised form
10th December, 2018
Accepted 29th January, 2019
Published online 28th February, 2019

Key Words:
Class II Malocclusion,
Functional Appliance.
hyoid Triangle, Retrognathia.

**Corresponding author:*

ABSTRACT

Introduction: The present study was conducted to understand changes in mean area of nasopharynx, hyoid triangle and position of hyoid bone in patients with retrognathic mandible after functional appliance therapy. ***Methods:*** Fourteen Class II malocclusion subjects in growing age with mandibular retrusion were selected. Mandibular retrusion in subjects was corrected by functional appliance therapy. Effect of functional appliances on nasopharynx and hyoid bone dimensions were evaluated from lateral cephalograms recorded before and after appliance therapy. Paired t- test was used for statistical analysis. ***Results:*** Mean area of nasopharynx and hyoid triangle was evaluated. It was found that there was increase in mean area of nasopharynx which is statistically significant with a P value of 0.004 in post cephalograms of treated subjects .It was also found that there was decrease in mean value of hyoid triangle in post cephalogram of treated subjects which was found statistically not significant with a P value of 0.773. There was mean decrease inhyoid distance from third cervical vertebrae which shows an upward movement of hyoid bone. ***Conclusion:*** Forward mandible displacement occurs with functional appliance therapy and, there were significant changes in the mean area of nasopharynx, and there is decrease in the mean area of hyoid triangle with upward movement of hyoid bone after functional appliance therapy.

Citation: ***Narayana Prasad, P., Tarun Kumar, Tarun Sharma, Anupa Rawat and Mansi Rawat.* 2019.** "Assessment of change in mean area of nasopharynx, hyoid triangle and position of hyoid bone after functional appliance therapy", *International Journal of Current Research*, 11, (02), 1329-1333.

INTRODUCTION

Pharynx, a tube-shaped structure formed by muscles and membranes, is located behind nasal and oral cavities, and extends from the cranial base to the level of the sixth cervical vertebra (Soheilifer, 2014). The pharyngeal airway is the first component of the significant structures, which provides respiration, one of the vital functions of the human body. Because of the close anatomical, structural and functional relationship between the pharynx, soft palate, tongue, epiglottis, hyoid bone and craniofacial and dentofacial structures such as cranial base, maxilla and mandible, a mutual interaction in terms of growth and function between them is expected (Maghsoudi, 2015). Pharyngeal airway space size is determined primarily by relative growth and size of the soft tissues surrounding the dentofacial skeleton. Studies have shown that the pharyngeal airway space is reduced, than normal in individuals with short cranial base and in cases of retrognathia or micrognathia. Angle showed that Class II Division 1 malocclusion was associated with upper airway obstruction and mouth breathing. Mergen and Jacobs reported that nasopharyngeal depth was significantly larger in patient with normal occlusion than in Class II malocclusion (Soheilifer, 2014).

In addition, different anatomic features of the maxilla and mandible could change the position of the hyoid and soft palate and lead to decreased dimension of posterior airway space. Suprahyoid muscles and Infrahyoid muscles and their effect on the shape, growth, external and internal angles of mandible have been less considered. Hyoid bone as a link between suprahyoid and infrahyoid muscles has a significant role in orientation and even in function of these muscles which should not be disregarded (Amayeri, 2013).

Significant difference in position of hyoid bone was found between Class I, Class II and Class III malocclusions (Allhaija, 2015). As the relationship between the Pharyngeal airway and changes in facial morphology has been extensively debated in the literature and still remained controversial, therefore in view of the need to uncover new evidences to contribute to and assist in addressing this complex issue, this study was carried out by tracing certain reference points, lines and angles on digitalized lateral cephalograms to evaluate the variations in mean area of nasopharynx, hyoid triangle and position of hyoid bone in Class II malocclusion and to derive clinical implications of study as applicable to Orthodontic treatment planning.

MATERIALS AND METHODS

The present cephalometric study was done on untreated Orthodontic patients. Class II malocclusion subjects in the growing age were selected who visited to the OPD at Department of Orthodontics and Dentofacial Orthopaedics, Seema Dental College and Hospital, Rishikesh. The study comprised of 14 subjects in growing age, breathing comfortably through nose. All digital Cephalometric radiographs were taken in NHP and patients were asked to swallow while shooting for cephalogram. All Cephalograms were taken using Kodak 8000C Panoramic and Cephalometric unit at Tube voltage of 60-90kVp, Digital censor CCD with 1360X1840 Pixels and magnification of 1:1%.

Tracing method: The lateral cephalograms obtained were traced on fine acetate matte tracing paper measuring 8X10-inchand 0.003-inch in thickness using a trans-illuminator. To trace the landmarks, the room was kept dark and the area was restricted on the view box. The measurements were performed manually using 3H pencil, a ruler to the nearest 0.1 mm, eraser, sharpener, Coloured ball point tip pens , Protractor and set squares.

Inclusion criteria

- Sample should be in a growing age
- Cervical Vertebral Maturation Stage III and IV
- Skeletal Class II Malocclusion
- Retrognathic mandible
- Convex profile
- Positive VTO
- Overjet of more than 5 mm.
- Mild/no teeth rotations.
- Crowding/spacing not more than 2 mm.
- Subjects should be able to breathe comfortably through nose.
- Subjects with history of tonsillitis and pharyngitis, major trauma to craniofacial region, orthognathic surgery, mouth breathing and previous orthodontics treatment were excluded.

Cephalometric landmarks used in the study

The Hard Tissue Landmark

Nasion (N)	The most anterior point on nasofrontal suture in median plane
Sella (S)	The midpoint of the hypophyseal fossa
Sella entrance(Se)	Midpoint of the line connecting the posterior cliniod process and anterior opening of the sella tursica, at the level of the Jugum sphenoidale.
Soft tissue Nasion (N')	Point formed by extension of Se- N anteriorly on soft tissue
Orbitale (Or)	Lowermost point of orbit in the radiograph.
PNS	Constructed point, intersection of a continuation
Basion(Ba)	pterygopalatine fossa and floor of the nose
Menton(Me)	Lowest point on anterior margin of foramen magnum
C3	in median plane
H point	Most Caudal point on bony symphysis , in median
Rgn	plane
Aa	Antero inferior point on the third cervical vertebrae
	Most anterior and inferior point on surface of hyoid bone
	Most postero inferior point on symphysis of mandible
	Most antero superior point on atlas vertebrae

Cephalometric landmarks, reference lines, parameters to assess area of nasopharynx, hyoid triangle and position of hyoid bone are given in Diagram 1,2 and 3respectively.

Parameters used to assess area of nasopharynx, hyoid triangle and position of hyoid bone

Linear measurements

Area of nasopharynx

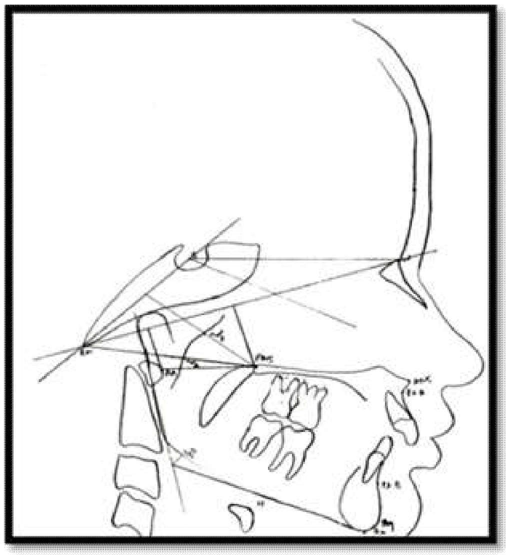

Fig. 1. Cephalometric tracing illustrating the points and linear measurements: PNS-Ba: Total depth of nasopharynx; AA-PNS: floor of nasopharynx; AA perp Ba-Nasion; PNS perp Ba-Nasion

- Aa-PNS- line extending from antero superior part of atlas vertebrae to PNS.
- Ba-Nasion – line extending from Ba to Nasion
- Ba-PNS- line extending from basion to PNS
- Aa perp to Basion- Nasion plane
- PNS perp to Basion-Nasion plane

Area of hyoid triangle

Fig. 2. Linear distance from anterior point of C3 to H point most anterior and inferior point on surface of hyoid bone:Linear measurement from H point to Rgn, most postero inferior point on symphysis of mandible

- C3 point to H point
- H point to Rgn
- Rgn to C3 point

Hyoid, C3 and Menton relationship

Perpendicular distance from H to the line inferior- anterior tip of cervical third vertebrae (c3) to menton

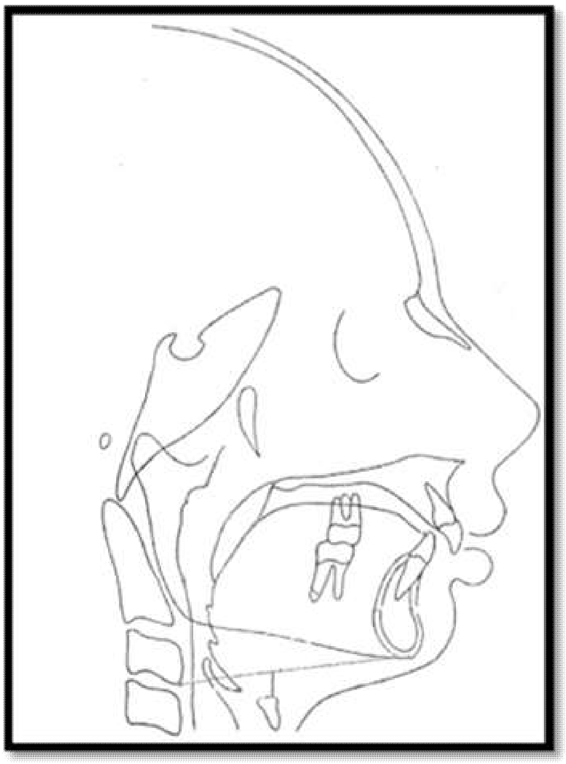

Fig. 3. Linear measurement from most anterior point on C3 to menton: Perpendicular distance from H to the line inferior-anterior tip of cervical third vertebrae (c3) to menton

Statistical analysis: Descriptive statistics including mean and standard deviation for the evaluation of area of nasopharynx, hyoid triangle and position of hyoid bone.

RESULTS

The results of the statistical analysis with mean, Standard deviation, and p values are shown in the (Table 1, Table 2 and Table 3) and (Graph a) and (Graph b).

Area of nasopharynx: As shown in the table number I ,the mean values of N was 151.95±57.1 and N' was 202.75±75 .On comparison of mean values of N pre (mm) and mean value of N' post (mm) is higher with a difference of -50.80mm is statistically significant with a p value of 0.004*.

Hyoid triangle: As shown in the Table number 2, the mean values of H was 3.143±94.9mm and H' was 0.929±121.3mm. On comparison of mean values of H pre (mm) and mean value of H' post (mm),the mean value of H' post (mm) has decreased with a difference of 8.5mm which is statistically not significant with a p value of 0.773.

C3, hyoid and menton relationship: As shown in the Table number 3, the mean values for hyoid C3 vertebrae and menton relationship pre (mm) was 3.143±5.9mm and post (mm) was 0.929±4.5mm.On comparison C3, hyoid and menton relationship pre (mm) and C3, hyoid and menton relationship post (mm)is higher with a difference of 2.2143mm is statistically not significant with a p value of 0.081

DISCUSSION

There is a mean increase in the area of nasopharynx which is statistically significant (p=0.004) as coinciding with the study by Restrepo et al (2007), that also suggests significant increase in the nasopharyngeal airway dimensions among Class II subjects treated by bionator appliance. However, in contrast to our study Ashok Kumar Jena, Satinder Pal Singh and Ashok Kumar Utrej (2013) suggested the minimal, on significant increase in depth of nasopharynx. Hyoid bone also referred to as lingual bone that is horse shoe shaped bone situated in the anterior midline of the neck between chin and thyroid cartilage.At rest it, lies at the level of base of mandible and third cervical vertebrae.The hyoid bone consists of unstable hard tissues that are completely supported by soft tissues connecting it to the skull base, mandible, pharynx and tongue. Positional assessment of hyoid bone is used to evaluate the physiological equilibrium state of the suprahyoid muscles, infrahyoid muscles and surrounding tissues of hyoid bone. Hyoid bone had been studied by many researchers, where they highlighted the different factors affecting the position of hyoid bone that mainly includes the antero posterior positioning of the mandible that is invariably affected by myofunctional therapy. Orthodontic myofunctional therapy has the potential to affect the hyoid bone by altering the mandibular position.

Several studies by Pae et al (2008), Eggensperger et al. (2005), Gale et al. (2001) have tried to determine the actual position of hyoid bone relative to cervical spine and hyoidal functional relationships with the craniomandibular system. These studies have shown changes in the position of hyoid bone and in pharyngeal size with the mandibular advancement. Decrease in the angulation of hyoid bone is also postulated following functional appliance therapy which is suggested to be due to the forward positioning of tongue. Verma G et al who found the highly significant upward displacement of hyoid bone in relation to mandibular plane following treatment with twin block appliance. According to Pouuseille's law, which states that as the radius increases and height decreases, resistance decreases. Therefore upward positioning of hyoid bone as a result of functional appliance therapy might decrease the airway resistance which is further influenced by the forward positioning of the tongue, thus reducing the impedance of pharyngeal airway. As it has been suggested that the head posture influence the dimensions of pharyngeal airway, so all the cephalometric radiographs of the subjects were recorded with the head in NHP (Natural Head Position). A normal nasal airway is dependent on sufficient anatomical dimensions of airway. Experimental studies using primates carried out by Harvold and associates also showed varied dentofacial forms and malocclusions, resulting after establishment of mouth breathing. On the other hand it has been mentioned in the literature that malocclusion type does not influence pharyngeal width (Watson et al., 1968; de Freitas et al., 2006; Alves et al., 2008).[14] Since the correlation of facial morphology to that of airway dimensions is still a controversy therefore the present study was conducted to find whether any changes are evident in mean area of nasopharynx, hyoid triangle and position of hyoid bone in patients with Class II malocclusion after

Table 1. Area of nasopharynx

	Mean	Std deviation	Mean diff	t-test value	P value
Areaof nasopharynx(pre)	151.95	57.18	-50.80	-3.508	0.004
Areaof Nasopharynx(post)	202.75	75.02			

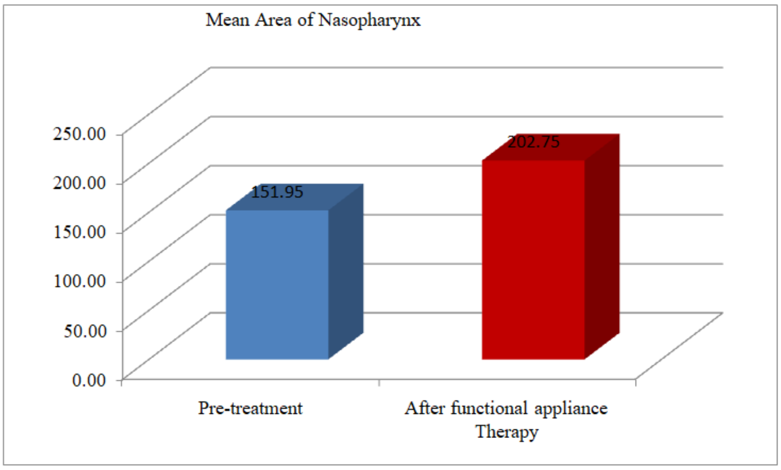

Table 2. Area of Hyoid triangle

	Mean	Standard deviation	Mean diff	t-test value	P value
Area of hyoid triangle(pre)	223.00	94.91	7.87	0.295	0.773
Area of hyoid triangle(pre)	215.13	121.37			

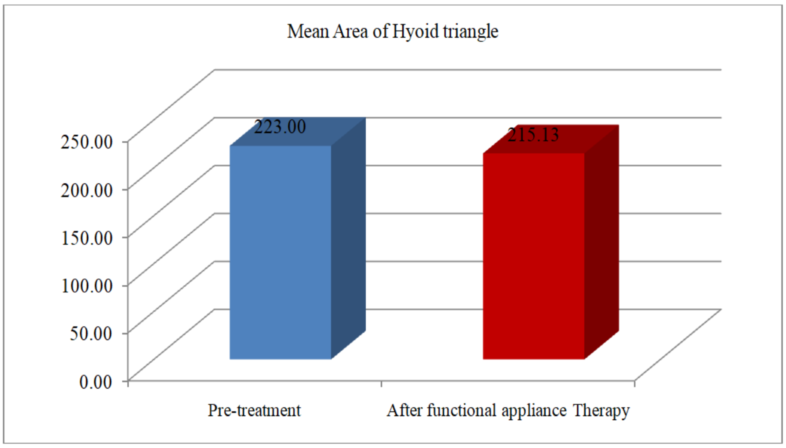

Table 3. C3 Hyoid and menton Relationship

Parameter	Mean	Standard deviation	Mean diff	t-test value	P value
Hyoid,C3 and menton (pre)	3.143	5.9918	8.5	1.89	0.081
Hyoid,C3 and menton (post)	0.929	4.5525			

functional appliance therapy. The present study showed that the upper pharyngeal airway was found to be decreased in Class II subjects, which was statistically significant. This was in accordance with the study of Kem et al, Angle and Kirjavainen et al who showed decrease in Upper pharyngeal width in Class II Subjects (Chang-Min Sheng, 2009). As the space between Cervical vertebrae and mandible decreases it causes obstruction in the upper airway thus reducing the width of upper pharyngeal space anteroposteriorly. Mergen and Jacobs reported that nasopharyngeal depth was significantly larger in patient with normal occlusion than in Class II malocclusion (Allhaija, 2005). Thus it can be concluded that as the mandible advances into more anterior position, the upper pharyngeal width also increases.

As the upper airway is compromised in Class II subjects the downward position of hyoid bone is the anatomic adaptation to maintain the stability and patency of the pharyngeal airway. After the mandibular advancement by functional appliance therapy the distance was found to be decreased. The vertical position of hyoid bone in relation to third cervical vertebrae was found upward in the subjects. Thus in the present study a significant correlation was found between area of nasopharynx, hyoid triangle and position of hyoid bone in patients with retrognathic mandible.

Conclusion

It was found that the area of nasopharynx was increased post treatment with the myofunctional appliances.

The mean area of hyoid triangle was found to be reduced post treatment that suggests the forward displacement of mandible after functional appliance therapy. Hyoid bone was found to be positioned upward post treatment. Therefore, the area of nasopharynx, hyoid triangle and position of hyoid bone has a significant correlation with the mandibular advancement.

REFERENCES

Allhaija ESA. Al-Khateeb SN. 2005. Uvulo-glosso-pharyngeal dimentions in different anteroposterior skeletal patterns. *Angle Orthodontist*., vol 75: no 6.

Amayeri M. Saleh F. Saleh M. 2013. The position of hyoid bone in different facial patterns: A lateral cephalometric study. J Uni Beirut.

Cagri Ulusoy. 2014. Nehir Canigur. Evaluation of airway dimensions and changes in hyoid bone position following Class II functional therapy with Activator. *Acta Odontologica Scandinavica.,* 72;917-925.

Calleja GZ. 2007. Human adaptation to high altitude and to sea level. Edi 1. Chap C. July; pg 25-27.

Chang-Min Sheng. Li-Hsiang Lin. 2009. Developmental changes in pharyngeal airway depth and hyoid bone position from childhood to young adulthood. Angle orthodontist, Vol 79,No 3

Hussel W. Nanda RS. 1984. Analysis of factors affecting angle ANB. *Am J Orthod.,* 85:411-423.

Indriksone I. Jakobsone G. 2014. The upper airway dimensions in different sagittal cariofacial patterns: A systemic review. Baltic dental and maxillofacial journal. 16:109-17.

Ishikawa H. Nakamura S. Iwasaki H. Kitazawa S. 2000. Seven parameters describing anteroposterior jaw relationship; postpubertal prediction accuracy and interchangeability. *Am J Orthod Dentofacial Orthop.,* 117:714-720.

Jacobson A. 1975. The Wits appraisal of jaw disharmony. *Am J Orthod.,* 67:125-138.

Maghsoudi S. Azerbayejani S. 2015. Cephalometric analysis of hyoid bone position in different jaw dysplasias. *J Res Dent sci.,* 11(4):220-228.

Nicole Eggensperger. 2005. Koord Smolka.Long term changes of hyoid bone and pharyngeal airway size following advancement of mandible. *Oral Surg Oral Path Oral Med Oral Radiol Endod.,* 99:404-

Oktay H. 1991. A comparison of ANB, WITS, AF-BF, and APDI measurements. *Am J Orthod Dentofacial Orthop.,* 99: 122-128.

Samman N. Mohammadi H. Xia J. 2003. Cephalometric norms for upper airway in a healthy Hong Chinese population. *Hong Kong Med J.,* 0:25-30.

Soheilifer, S. 2014. Upper airway dimensions in patients with Class I and Class II skeletal pattern. *Avicenna J Dent Res.,* December 6(2); e23300.

****