Evaluation of airway spaces in class II & class III skeletal cases before and after orthognathic surgery

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ABSTRACT

Aim: The purpose of the study was to examine the changes in dimension of pharyngeal airway spaces after surgery in class II and class III skeletal malocclusion.

Methods: This study included 50 patients of class II and class III skeletal and dental malocclusion who had undergone orthognathic surgery. The pre and post treatment lateral cephalograms were taken to calculate upper and lower air way spaces before and after the surgery.

Results: Changes in upper and lower airway spaces was seen in Class II cases only.

Conclusion: Maintaining of lower air way spaces in surgical class III cases of mandibular set back.

Keywords: Pharyngeal spaces, nasopharynx, orthognathic surgery

INTRODUCTION

The nasopharynx is a musculo-membranous tube serving as a portal between the nasal chamber anteriorly and the oral pharynx inferiorly. Its primary biologic function is to provide a passage for air from the nasal chamber to the oral pharynx, laryngeal pharynx and ultimately to the lungs. The nasopharynx also provides space on its posterior and superior wall for lymphoid tissue in the form of the nasopharyngeal tonsils as part of Waldeyer's tonsillar ring. This tissue, often seen to be hypertrophied during childhood, is also denoted as "adenoid". The enlargement of the adenoids may lead to partial or total blockage of the nasopharyngeal passage making nasal respiration either inefficient or impossible. Thus the concurrent function of the nasopharynx as the site for the passage of nasal airway flow, may be in conflict[1].

The potential disharmony between the adenoid mass and the nasopharyngeal airway may be due to the difference in growth patterns of the bony nasopharynx and the attached tonsillary tissue[2].Obstruction of the nasopharynx predisposes a child to chronic mouth breathing, pathognomic for "respiratory obstruction syndrome" described by Ricketts[3]

In 1972, Tomes[4] hypothesized that maxillary constriction could be caused by lymphatic tissue hypertrophy of the pharynx that leads to the absence of lip seal and a lower tongue position to maintain the permeability of the airway. From early adulthood to later years (approximately 20-50 years of age), the nasopharyngeal skeleton hardly changes. Posterior nasopharyngeal depth increases as the posterior pharyngeal wall becomes thinner. This means that pharyngeal morphology not only changes during childhood and adolescence, but also varies during adulthood[5]. Adenoid hypertrophy is an important cause of nasal obstruction[6] and is commonly related to many symptoms, including mouth breathing[7,8]. As a consequence, oral respiration leads to significant neuromuscular and soft-tissue rearrangements[9,10] which might result in distorted craniofacial growth and orthodontic alterations[11-14].

Mandibular advancement and setback BSSO surgery improves the occlusion, function and esthetics by changing the position of the mandible in both Class II and Class III malocclusion.

MATERIALS AND METHOD

50 patients having class II and III dental and skeletal characters (25 each) treated by orthognathic surgery, were analysed using pre-treatment and post-treatment cephalograms taken in natural head position, for calculating upper - lower air way.

Class II skeletal cases were surgically treated with BSSO advancement and class III skeletal cases were surgically treated with BSSO setback. Growth pattern was based on Go-Gn to SN and GO-Me to SN and skeletal pattern was based on Wits appraisal (AO-BO) and ANB angle. Upper Air way spaces were calculated by Mc Namara[15] and Handelman and Osborne[16].Lower air way space was measured from posterior border of tongue intersecting with lower border of mandible.

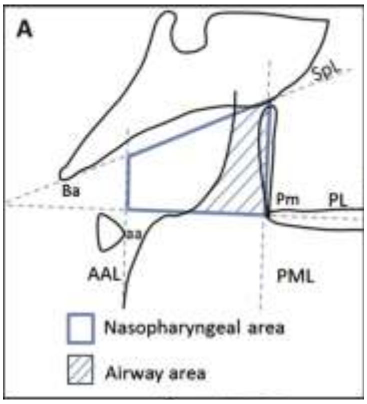

Fig 1: Handelman and Osborne Airway area (Aa) (%): (airway area/nasopharyngeal area) x 100

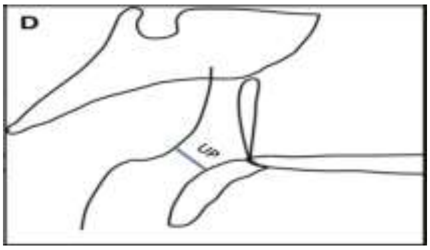

Fig 2: Upper pharynx (UP) (mm): nearest distance from a point on the posterior outline of the soft palate and a point on the adenoid outlineLower air way spaces was calculated by Mc Namara

RESULT

Table 1 The mean of lower airway space of class II pre-treatment was 11.60 ± 3mm and post treatment was 13.48± 2.19mm. It was observed that lower airway space post treatment was increased. The mean change in airway space area was significant (Sig.). The mean of lower airway space of class III pre-treatment was 12.64 ± 4.50 mm and post treatment was 12.04 ± 3.22 mm. The mean change in airway space from pre to post treatment was 0.60 ± 2.99 mm. The mean change in airway space was not significant (NS).

Table 1: Lower airway space pre & post of class II & class III subjects (mm) (McNamara Analysis).

Group	Mean ± SD		Mean change ±SD	P- value	Sing
	Pre	Post			
Class II	11.60 ± 3.00	13.48 ± 2.19	-1.88±3.40	<.01	Sig
Class III	12.64 ± 4.50	12.04 ± 3.22	0.60± 2.99	>.05	NS

Table II The mean of upper airway space of class II pre-treatment was 14.32 ± 4.21 mm and post treatment was 16.76 ± 3.67 mm. It was observed that upper airway space post treatment was increased. The mean change in airway space from pre to post treatment was 2.44 ± 1.88. This mean change in airway in airway space area was highly significant (HS). The mean of upper airway space of class III pre-treatment was 14.16 ± 3.11 mm post treatment was 14.32 ± 3.46 mm. It was observed that upper airway space post treatment did not have much difference. The mean change in airway space was not significant (NS).

Table 2: Upper way space pre & post of class II & class III subjects (mm) (McNamara Analysis).

Group	Mean ± SD	Mean change ±SD	P- value	Sing

	Pre	Post			
Class II	14.32± 4.21	16.76± 3.67	2.44±1.88	<.001	HS
Class III	14.16± 3.11	14.32± 3.46	0.16± 2.78	>.05	NS

Table III The mean of nasopharynx area of class II pre-treatment was 799.12 ± 205.35 mm^2 post treatment was 891.97 ± 227.79 mm^2. It was observed that nasopharynx area post treatment was increased. The mean change in area from pre and post treatment was 92.85 ± 157.85. The mean change in nasopharynx area was significant. The mean of nasopharynx area of class III pre-treatment was 827.78 ± 114.08 mm^2 and post treatment was 782.78. ± 112.23 mm^2. It was observed that nasopharynx area post treatment had decreased. The mean change in area from pre and post treatment was 6.31 ± 76.23. The mean change in nasopharynx area was not significant.

Table 3: Nasopharynx area pre & post of class II & class III subjects (mm^2) (Handelman and Osborne)

Group	Mean ± Sd		Mean change ±Sd	P- value	Sing
	Pre	Post			
Class II	799.12± 205.35	891.97± 227.79	92.85±157.80	<.01	Sig
Class III	827.78± 114.08	782.45± 112.23	6.31± 76.23	>.05	NS

DISCUSSION

In this study, it was found that subjects with a more retruded mandibular position with respect to the cranial base tended to have smaller OP airway volumes. Also, a significant increase in Class II cases showed increase in upper and lower pharyngeal air space (PAS) where as in case of Class III there was no significant change in PAS in both Mc Namara and Handelman and Osborne analysis. Kim et al[17] stated that retrognathic patients tended to have a smaller airway volume compared with patients with a normal anteroposterior skeletal relationship. For this two mechanisms are possible. First, anterior movement of the tongue may decrease the gravitational effect on the soft palate and it is assumed that the base of the tongue opposes the anterior wall of the soft palate. Second, forward displacement of the mandible may decrease collapsibility of the velopharynx because the lateral wall of the soft palate anatomically connects to the base of the tongue through the palatoglossal arch, and mandibular advancement possibly stretches the soft palate through the mechanical connection, stiffening the velopharyngeal segment.

Riley et al[18] suggested that mandibular setback might contribute to further development of OSAS after surgery and it could be associated with airway patency because airway resistance appears to increase after surgery[19]. Kawakami et al[20] demonstrated that PAS was maintained shortly after mandibular setback surgery. It was assumed that a reflex alteration in the pharyngeal muscular mechanism and the biomechanical conditions of the supra and infrahyoid muscles takes place postoperatively in patients seeking orthognathic surgery often are characterized by altered patterns of craniomandibular neuromuscular function, which differ from those of the normal or healthy population. Therefore, it is important that a detailed clinical examination and an accurate diagnosis precede this interdisciplinary management.

CONCLUSION

Current evidence suggests that the greatest use of lateral cephalograms is as a screening tool for determining whether more intensive follow up is needed. Mandibular advancement surgery can increase the airway spaces in class II skeletal base. In patients with large adenoids and OSA where airway spaces is less than normal, mandibular setback can further reduce the airway spaces. During treatment planning one should keep all these things into consideration.

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