

CO-RELATION OF ORO-PHARYNGEAL AIRWAY (OAW) SPACE IN CLASS II SKELETAL MALOCCLUSION TREATED WITH FUNCTIONAL APPLIANCES -A RETROSPECTIVE STUDY

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ABSTRACT

Background: Respiratory function is highly relevant to orthodontic diagnosis and treatment planning. Skeletal features such as retrusion of mandible may lead to narrower anteroposterior dimension of the airway.

Aims: The present study aimed to evaluate the influence of removable and fixed functional mechanotherapy on the upper and lower pharyngeal airway space in Class II patients during peak pubertal and post pubertal growth spurt.

Materials and Method: A cross-sectional retrospective study was carried out on a total of 20 subjects with age group ranging from 9 -15 years. These patients had ANB angulation greater or equal to 4 degrees and presented with Class II skeletal patterns (mandibular retrusion). They were divided into two groups with subjects receiving removable functional treatment with Twin Block and fixed functional treatment with FORSUS (3M Unitek) over a minimum period of 7-8 months. Pre and Post cephalometric tracings were done to evaluate the changes in both the upper and lower pharyngeal airway space.

Results: Subjects treated with Removable functional mechanotherapy showed a mean change of 15.1% in the upper pharyngeal space while the lower pharyngeal airway space showed a mean change of 25.5% whereas those treated with Fixed functional mechanotherapy showed a mean change of 15.2% in the upper pharyngeal space and a mean change of 18.3% in the lower pharyngeal space.

Conclusions: Results confirmed that both removable and fixed functional appliances have a significant role in increasing the

upper and lower pharyngeal airway spaces in patients with mandibular deficiencies, though removable functional appliances had a greater effect on the lower pharyngeal airway space in contrast to fixed functional appliances.

INTRODUCTION

Respiratory function is highly relevant to orthodontic diagnosis and treatment planning. The growth and function of nasal cavity, the nasopharynx, and the oropharynx are closely associated with the normal growth of the skull. In addition the nasopharynx and the oropharynx have important locations and functions as they both form part of the unit in which respiration and deglutition are carried out. Numerous researchers reported the interaction between pharyngeal dimensions and various sagittal and vertical facial growth patterns at varying degrees¹.

Significant relationships between the pharyngeal structures and both dentofacial and craniofacial structures have been reported. Skeletal features such as retrusion of mandible may lead to narrower anteroposterior dimension of the airway. On the other hand the oro-pharyngeal airway has been claimed to affect the growth of craniofacial structures. Recently, interest has been focused on relationship between size and structure of upper airway space and sleep induced breathing disturbances². Along with exogenous factors such as alcohol or sedatives, the occurrence of the obstructive sleep apnea syndrome (OSAS) is favored by alterations in the area of the airways³.

Soft palate dimensions and their dynamic relations with the pharyngeal airway space have an important role in swallowing, respiration and phonation. The velopharyngeal closure mechanism functions to

control nasal airflow and disorders in this mechanism may cause phonation problems⁴.

Therefore, the present study aimed to evaluate the influence of removable functional and fixed functional mechanotherapy on the upper and lower pharyngeal airway space in Class II patients during peak pubertal and post pubertal growth spurt.

AIMS AND OBJECTIVES

1. Assessment of upper and lower oro-pharyngeal airway space in individuals treated with removal functional mechanotherapy
2. Assessment of upper and lower oro-pharyngeal airway space in individuals treated with fixed functional mechanotherapy
3. To establish a correlation in upper and lower oro-pharyngeal airway space changes in patients treated with functional and fixed functional treatment modalities.

MATERIALS AND METHOD

This research was designed as a cross-sectional retrospective study on the basis of the records present in our department of Orthodontics and Dentofacial Orthopedics. A total of 20 subjects, both males and females with age group ranging from 9 -15 years were selected for the study. These patients had ANB angulation greater or equal to 4 degrees and presented with Class II skeletal patterns (mandibular retrusion). None of the subjects had any history of upper airway pathology i.e. patients could breathe comfortably through nose. Patient with medical history of craniofacial deformity, history of breathing disorder, history of nasal obstruction or history of adenoidectomy / tonsillectomy were excluded from the study.

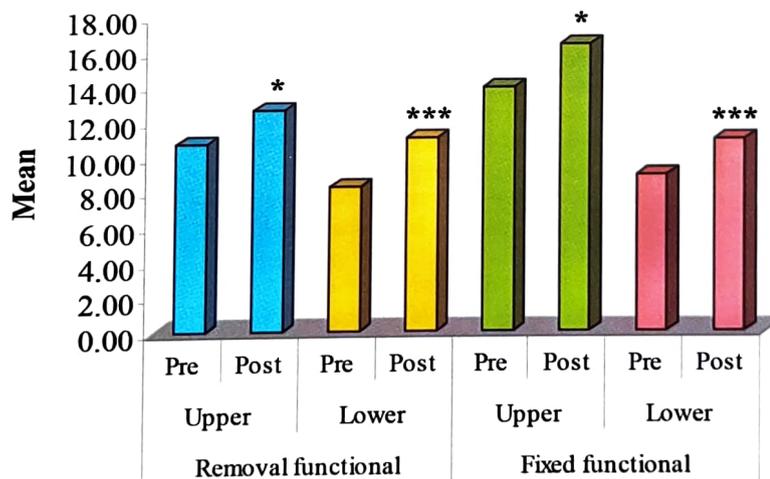
Subjects had undergone functional treatment depending on the growth status

Table 1: Pre and post treatment upper and lower pharyngeal airway space (Mean ± SD, n=10) in patients treated with removable and fixed functional mechanotherapy

Functional mechano therapy	Site	Pre treatment	Post treatment	Mean change (Post-pre)	% mean change	t value (DF=9)	P Value
Removable	Upper	10.70 ± 1.49 (9-13)	12.60 ± 2.22 (9-16)	1.90 ± 1.97 (0-7)	15.1%	3.05	0.014
	Lower	8.20 ± 2.04 (5-12)	11.00 ± 1.41 (9-13)	2.80 ± 1.62 (1-7)	25.5%	5.47	p<0.001
Fixed	Upper	13.90 ± 2.38 (10-18)	16.40 ± 3.69 (12-24)	2.50 ± 2.72 (1-10)	15.2%	2.91	0.017
	Lower	8.90 ± 1.66 (7-12)	10.90 ± 1.66 (8-13)	2.00 ± 0.82 (1-3)	18.3%	7.75	p<0.001

Numbers in parenthesis indicates the range (min-max)

Pharyngeal airway space (mm)



*p<0.05 or ***p<0.001- pre vs. post

Fig. 1. Pre and post treatment upper and lower pharyngeal airway space of two groups.

and compliance. They were divided into: Subjects receiving Removable Functional treatment with Twin Block over a minimum period of 1 year and subjects that had received Fixed Functional treatment with FORSUS (3M Unitek) over a minimum pe-

riod of 7-8 months.

Pre and Post cephalometric tracings were done to evaluate the changes in both the upper and lower pharyngeal airway space.

STATISTICAL ANALYSIS:

Data were summarized as Mean ± SD. Pre and post data were compared by paired t test. The change in variables between subjects treated with removable and fixed functional mechanotherapy were compared by

Change (post-pre) in pharyngeal airway space (mm)

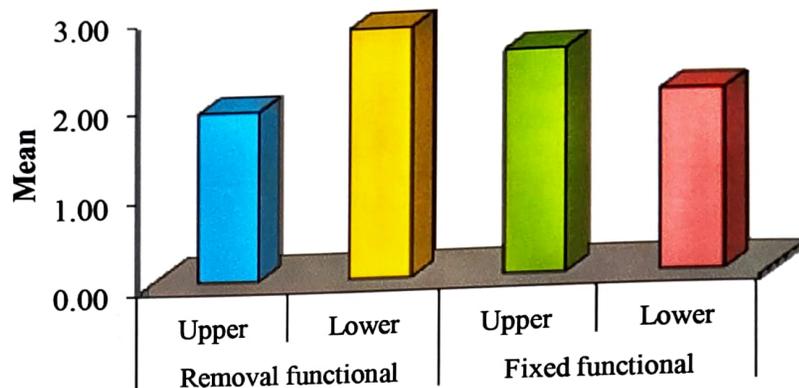


Fig. 2. Change (post-pre) in upper and lower pharyngeal airway space of two groups.

one way analysis of variance (ANOVA) and the significance of mean difference between the groups was done by Tukey's post hoc test. A two-sided $p < 0.05$ was considered statistically significant.

RESULTS

- Subjects treated with Removable functional mechanotherapy showed a mean change of 15.1% in the upper pharyngeal space while the lower pharyngeal airway space showed a mean change of 25.5%.
- Subjects treated with Fixed functional mechanotherapy showed a mean change of 15.2% in the upper pharyngeal space while the lower pharyngeal airway space showed a mean change of 18.3%.
- Mean change in the upper pharyngeal airway space for subjects treated with either Removable or Fixed functional mechanotherapy was seen to be almost similar in contrast to the mean change observed in the lower pharyngeal airway space.
- Mean change in the lower pharyngeal airway space for subjects treated with Removable functional mechanotherapy was higher when compared to subjects treated with Fixed functional mechanotherapy.
- Statistically significant changes were observed in the lower pharyngeal airway space for subjects treated with either Removable or Fixed functional mechanotherapy

($p < 0.001$)

DISCUSSION

A significant relationship is known to exist between retrognathic maxillary and mandibular structures and obstructive sleep apnea (OSA). If the orthodontist can correct the skeletal pattern and increase OAW capacity permanently especially in those patients who have retrognathic and small maxilla mandibular structures and small OAW dimensions, then the occurrence of OSA in the later stages of life could be avoided. It is not surprising that many orthodontic patients who have history of snoring at the beginning of Functional or orthopedic treatment report a reduction in these symptoms, even at the early stages of treatment. These benefits should not be underestimated, as it has been demonstrated that there may be a link between sleep patterns and nocturnal release of growth hormone. Any factor that leads to an insufficient sleep pattern may cause a reduction in plasma growth hormone levels, which may in turn not only slow down the overall growth rate but also cause a reduction in condylar activity and thereby mandibular growth^{6,7}.

Even if there are no upper airway pathologies such as oversized adenoids and tonsils or chronic respiratory problems, the

functional therapy might reduce the chances of having disturbed respiratory function during sleep such as snoring, UARS or OSA⁵.

The present study aimed to evaluate the influence of removable functional and fixed functional mechanotherapy on the upper and lower pharyngeal airway space in Class II patients during peak pubertal and post pubertal growth spurt.

Results confirmed that both removable and fixed functional appliances have a significant role in increasing the upper and lower pharyngeal airway spaces in patients with mandibular deficiencies, though removable functional appliances had a greater effect on the lower pharyngeal airway space in contrast to fixed functional appliances. Since the subjects chosen were free of any upper airway pathologies both removable and fixed functional appliances affected the upper pharyngeal airway space equally. The findings were supported by Restrepo C, Santamaría A, Peláez S, Tapias A, who had evaluated the changes in the airway dimensions of class II retrognathic children who received treatment with either Klammt or Bionator on a pre-pubertal stage and had found a statistically significant increase in the airway dimensions that was found at the space where the adenoid tissue was located i.e. near the nasophar-

ynx8. Ozbek MM, Memikoglu TU, Gögen H, Lowe AA, Baspinar E also reported that OAW dimensions increased significantly in treated patients, especially those with sagittally smaller and more retrognathic maxilla-mandibular complexes and smaller OAW dimensions⁹.

Therefore, an increase in OAW dimensions in growing patients with mandibular deficiency may have some major benefits in terms of craniofacial growth and function. If increases in these dimensions result in an increase in OAW capacity and thereby better daytime and nocturnal respiratory function, the possible effects of an impaired OAW which function as an etiologic factor for abnormalities in the facial structures might be reduced. This might even modify the sagittal and or vertical growth pattern of the orofacial complex. Similar retrospective and prospective studies are needed over a larger sample size to validate the above data.

CONCLUSION

Our results clearly suggest the existence of a relationship between functional treatment and increase in oropharyngeal airway dimensions in Class II growing subjects.

1) Both Removable and Fixed functional appliances influence the upper and lower pharyngeal airway space

2) Both Removable and Fixed functional appliances were found to increase the lower oropharyngeal space more when compared with the upper oropharyngeal space

3) Removable functional appliances have a greater influence on lower oropharyngeal space when compared with Fixed functional appliances.

Further studies are needed to evaluate if increasing OAW dimensions by means of functional treatment in cases with skeletal Class II patterns and mandibular deficiency will prove to have favorable outcomes such as modification of growth pattern of the craniofacial structures and / or a reduced chance of having impaired respiratory function in short or long term.

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