

Estimation of Change in Pharyngeal Airway Passage Dimensions with Twin-Block Appliance in Patients with Class II Malocclusion

Sakshi Raina^{1*}, Romshi Raina², Sony Vhatkar³, Shraddha Jadhav³

¹MDS, Orthodontist, ACPM Dental College, Dhule, Maharashtra, India

²Registrar, Department of Public Health Dentistry, Govt. Dental College, Srinagar, J & K, India

³PG Student, Department of Orthodontics, ACPM Dental College, Dhule, Maharashtra, India.

ABSTRACT

Background: Angle Class II malocclusion with mandibular retrognathia is a common dento-facial deformity. It is characterized by skeletal retrusion of mandible with skeletal or dentoalveolar protrusion of maxillary.

Aim of the Study: To estimate changes in pharyngeal airway passage dimensions with twin-block appliance in patients with Class II malocclusion.

Materials and Methods: The present study was conducted in the Department of Orthodontics and Dento-facial Orthopedics of the dental institution. For the study, we selected 30 subjects in the age range of 8 to 14 years with skeletal class II malocclusion associated with mandibular retrusion. Subjects with a history of orthodontic treatment, anterior open-bite, severe proclination of the anterior teeth, and any systemic disease affecting bone and general growth were excluded from the study.

Results: A total of 30 subjects were included in the study. The age of subjects ranged from 8-14 years. Number of male subjects was 13 and female subjects were 17. We observed that DNP was increased by 0.34, HNP increased by 0.43 mm, DOP increased by 2 mm, DHP increased by 1.69 mm, SPL

decreased by 1.69mm, SPT increased by 0.38 mm and SPI decreased by 2 mm. The results for DOP and SPT were statistically significant ($p < 0.05$).

Conclusion: From the results we conclude that the use of twin-block appliance for class II patients corrects sagittal dimension of oropharynx and hypopharynx.

Keywords: Class II Malocclusion, Twin Block Appliance, Functional Appliance.


*Correspondence to:

Dr Sakshi Raina,
149/c Wazir Bhag,
Surya-Vihar, Patta Bohri,
Jammu Tawi, Jammu & Kashmir, India.

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INTRODUCTION

Angle Class II malocclusion with mandibular retrognathia is a common dento-facial deformity. It is characterized by skeletal retrusion of mandible with skeletal or dentoalveolar protrusion of maxillary.¹ Three-dimensional (3D) imaging studies of upper airway have shown that patients with retruded mandible have a significantly narrowed pharyngeal space compared with normal subjects, which was attributed to a more backward position of the hyoid bone.^{2,3}

Some researchers reported that an inadequate airway may influence nasal respiratory function, and even induce symptoms of obstructive sleep apnea syndrome (OSAS) in growing patients.⁴ Therefore, early diagnosis and proper functional appliance therapy in growth period are indispensable for correcting this type of malocclusion. The use of functional appliances for the correction of retrognathic mandible is very common in orthodontics. Similar appliances known as oral appliances are also frequently used in

adults for the treatment of mild to moderate OSA.⁵ Many previous studies reported improvement of PAP dimensions following functional appliance therapy in children and oral appliance therapy in adults. Although, there is one study in the literature mentioning the effect of oral appliance therapy on posterior pharyngeal wall thickness (PPWT) but there is no information in the literature mentioning the effect of functional appliance therapy on PPWT.⁶⁻⁸ Hence, the present study was conducted to estimate changes in pharyngeal airway passage dimensions with twin-block appliance in patients with Class II malocclusion.

MATERIALS AND METHODS

The present study was conducted in the Department of Orthodontics and Dento-facial Orthopedics of the dental institution. The ethical clearance of the study was obtained from the ethical committee of the institute before starting the study.

For the study, we selected 30 subjects in the age range of 8 to 14 years with skeletal class II malocclusion associated with mandibular retrusion. Subjects with a history of orthodontic treatment, anterior open-bite, severe proclination of the anterior teeth, and any systemic disease affecting bone and general growth were excluded from the study. A written informed consent was obtained from the parents or guardians of the subjects after verbally explaining them the procedure of the study. The class II malocclusion in treatment group subjects was corrected by standard twin-block appliance. One-step mandibular advancement was carried out during the wax bite registration. An edge-to-edge incisor relationship with 2- to 3-mm opening between the maxillary and mandibular central incisors was maintained for all subjects. The patients were instructed to wear the appliance 24 h/day,

especially during mealtimes and they were followed once in every 4 weeks. The pharyngeal airway passage (PAP) dimension was evaluated from lateral cephalograms. The variables evaluated were depth of the nasopharynx (DNP); height of the nasopharynx (HNP); depth of the oropharynx (DOP); depth of the hypopharynx (DHP); soft palate length (SPL); soft palate thickness (SPT); and soft palate inclination (SPI). The Lateral cephalograms with teeth in occlusion were obtained for all subjects before the start of treatment and after a follow-up period of approximately 4 months in treatment.

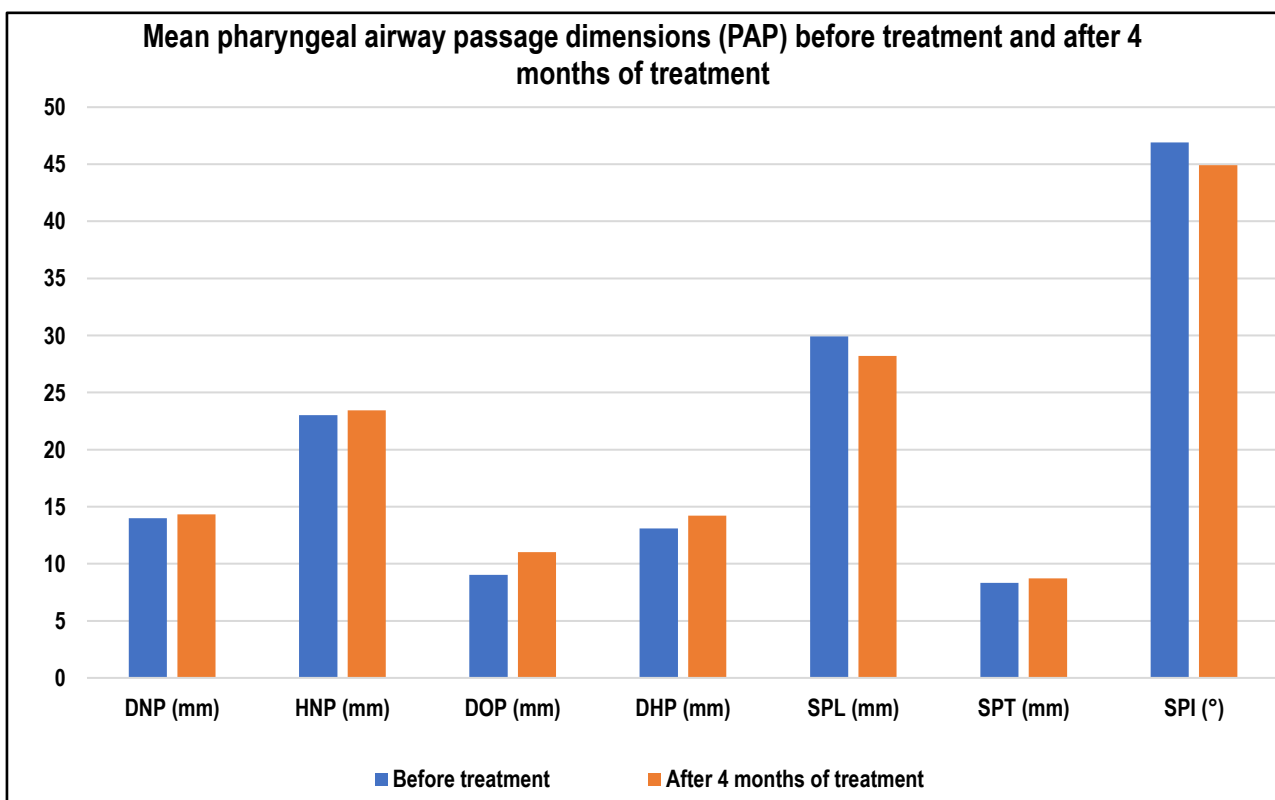
The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistical significant.

Table 1: Mean measurement of pharyngeal airway passage (PAP) before treatment and after 4 months of treatment

Pharyngeal airway passage variables (PAP)	Before treatment	After 4 months of treatment	p-value
DNP (mm)	13.99	14.33	0.21
HNP (mm)	23.01	23.44	0.71
DOP (mm)	9.02	11.02	0.005*
DHP (mm)	13.09	14.21	0.9
SPL (mm)	29.91	28.22	0.71
SPT (mm)	8.33	8.71	0.32
SPI (°)	46.91	44.91	0.001*

*Statistically significant

Fig 1: Mean measurement of pharyngeal airway passage (PAP) before treatment and after 4 months of treatment



RESULTS

A total of 30 subjects were included in the study. The age of subjects ranged from 8-14 years. Number of male subjects was 13 and female subjects were 17. Table 1 shows the mean measurement of pharyngeal airway passage (PAP) before treatment and after 4 months of treatment. We observed that DNP was increased by 0.34, HNP increased by 0.43 mm, DOP increased by 2 mm, DHP increased by 1.69 mm, SPL decreased by 1.69mm, SPT increased by 0.38 mm and SPI decreased by 2 mm. The results for DOP and SPT were statistically significant ($p < 0.05$). [Fig 1]

DISCUSSION

In the present study, we observed significant increase in the change in dimensions of pharyngeal airway passage. The results were significant with respect to DOP and SPT. The results were compared with previous studies.

Ghodke S et al evaluated the effects of twin-block appliance on pharyngeal airway passage (PAP) dimensions and posterior pharyngeal wall thickness (PPWT) in class II malocclusion subjects with retrognathic mandibles. The depth of the oropharynx was increased significantly in the treatment group subjects ($P < 0.001$) as compared to the control group subjects. The depth of the hypopharynx increased significantly in treatment group subjects. The PPWT at the level of the nasopharynx, oropharynx, and hypopharynx were maintained in the treatment group subjects; whereas in control group subjects, the PPWT was further reduced although the changes were not statistically significant. It was concluded that the correction of mandibular retrusion by twin-block appliance in class II malocclusion subjects increased the PAP dimensions and maintained the pre-treatment thickness of posterior pharyngeal wall.⁹

Ali B et al evaluated the mean changes in the pharyngeal dimensions of children with mandibular deficiency treated with Clark's twin-block appliance (CTB) followed by fixed orthodontic treatment. Orthodontic records of 42 children with mandibular deficiency were selected. Superior pharyngeal space and upper airway thickness were significantly increased after CTB, and the change in superior pharyngeal space remained stable after fixed mechano-therapy. They concluded that the CTB can have a positive effect in improving pharyngeal space and the resultant increase in airway remains stable on an average of two and a half years.¹⁰

Toth LR et al compared the treatment effects produced in 40 patients treated with the Twin-block appliance to those seen in a matched sample of 40 children treated with the FR-2 appliance of Fränkel and to changes undergone in 40 untreated Class II controls from The University of Michigan Elementary and Secondary School Growth Study. Significant decreases in overbite and overjet were observed at the end of treatment in the Twin-block and Fränkel groups. Compared with the untreated subjects, statistically significant increases in mandibular length were observed in both treated groups. The Twin-block patients achieved an additional 3.0 mm of mandibular length, whereas the Fränkel group increased 1.9 mm more than did the controls. No significant restriction of midfacial growth was observed in either functional appliance group relative to controls. A significant increase in lower anterior facial height was evident in both treatment groups. Vertical increase in the Twin-block patients was

significantly greater than in the FR-2 group. In general, more extensive dentoalveolar adaptation was observed with the tooth-borne Twin-block appliance than with the more tissue-borne FR-2 of Fränkel. The Twin-block and FR-2 samples both showed significant retroclination and extrusion (eruption) of the maxillary incisors. The Twin-block patients also exhibited distal movement of the upper molars; however, there was no extrusion. Slight lower incisor proclination was noted in both treatment groups, and lower molar extrusion was found to be significantly greater in the Twin-block group compared with the other 2 samples. No horizontal differences were detected in the lower molars among groups. The study suggested that Class II correction with the Twin-block appliance is achieved through normal growth in addition to mandibular skeletal and dentoalveolar changes. Xiang M et al evaluated the treatment effects of functional appliances (FAs) on upper airway dimensions in growing Class II patients with mandibular retrognathism. Seven studies (177 treated patients with mean age: 11.48 years and 153 untreated controls with mean age: 11.20 years) were included in this review. Compared to the control group, the oropharyngeal dimensions in the treatment group subjects were significantly increased at the superior pharyngeal space, middle pharyngeal space and inferior pharyngeal space. No significant differences were found in nasopharyngeal and hypopharyngeal dimensions and the position of hyoid bone. Soft palate length and soft palate inclination were improved significantly in the treatment group. The results showed that FAs can enlarge the upper airway dimensions, specifically in the oropharyngeal region, in growing subjects with skeletal Class II malocclusion.^{11,12}

CONCLUSION

From the results we conclude that the use of twin-block appliance for class II patients corrects sagittal dimension of oropharynx and hypopharynx.

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