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Original Article

Effect of retraction of anterior teeth on pharyngeal airway and hyoid bone position in Class I bimaxillary dentoalveolar protrusion

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ABSTRACT

Background: To test the hypothesis that the retraction of anterior teeth has no effect on the dimensions of pharyngeal airway and to evaluate the retraction of anterior teeth on each parameter of pharyngeal airway.

Methods: Twenty-two adult patients of Class I bimaxillary protrusion requiring first premolar extractions with maximum anchorage requirements were selected. The pharyngeal airway and dentofacial parameters of the patients were compared using pre- and post-treatment lateral cephalograms with the help of Student's paired *t*-test ($P < 0.05$). The relationship between airway size and dentofacial parameters was also evaluated using Pearson correlation coefficient.

Results: The upper and lower lips were retracted by 2.25 and 5.4 mm after retraction of the incisors. The tips of upper and lower incisors were retracted by 7.75 and 7.15 mm, respectively. There was a statistically significant decrease in SPP-SPPW ($P < 0.05$), U-MPW ($P < 0.001$), TB-TPPW ($P < 0.001$), and change in HRGN ($P < 0.01$). A significant correlation was observed between the amount of retraction of lower incisor and decrease in the pharyngeal airway posterior to soft palate ($r = 0.102$), tongue ($r = 0.322$), and change in HRGN ($r = 0.265$).

Conclusions: The size of the pharyngeal (velopharyngeal and glossopharyngeal) airway reduced and hyoid bone position changed after retraction of the incisors in extraction space in bimaxillary protrusive adult patients.

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Introduction

Bimaxillary dentoalveolar protrusion is a malocclusion characterized by proclined incisors with convex facial profile and lip incompetence. The cephalometric findings usually show an increased horizontal distance from the most protrusive point of upper lip to esthetic line, horizontal distance from the most protrusive point of lower lip – esthetic line, angle between the Frankfort horizontal plane and long axis of upper incisor, and angle between the mandibular plane and long axis of lower incisor.[1] Orthodontic treatment usually indicates extraction of four first premolars followed by retraction of anterior teeth in the extraction space.[2]

Studies[1–8] have been carried out in the past to evaluate the relationship between pharyngeal airway and skeletal, dental parameters, soft tissue matrix including musculature, and growth patterns. It has been seen in the past that tongue position changed in the oral environment after mandibular setback by sagittal split ramus osteotomy.[4] Significant correlation was observed between maxillary protraction in skeletal Class III children and increase in the nasopharyngeal airway.[5] Rapid maxillary expansion improved the nasopharyngeal airway and nasal width.[6] The correlation between craniofacial growth pattern and pharyngeal airway was found to be doubtful.[7,8]

Limited evidence-based research[9,10] is available on the correlation of the retraction of anterior teeth in bimaxillary protrusion patients undergoing extraction of four premolars and the pharyngeal airway. A recent study[9] showed that the orthodontic treatment with extraction of four premolars did influence oropharyngeal airway space in adults. Another study[10] showed that the same orthodontic treatment did not influence oropharyngeal airway in adolescents. This finding has been supported due to pharyngeal growth in adolescents, but specific changes at all levels of pharyngeal airway and hyoid bone were not considered. A study by Germec-Cakan et al.[11] reported a significant decrease of pharyngeal airway posterior to the tip of soft palate and tongue after retraction of anteriors. Only velopharyngeal and glossopharyngeal airway space was calculated. Other parameters like nasopharynx, hypopharynx, and airway length were not evaluated. It is a well-documented fact that significant changes in dentofacial parameters are expected during extraction orthodontic treatment, which changes soft tissue profile and incisor angulation. These changes are likely to influence tongue position and pharyngeal airway.[10] Literature about this aspect is still not sufficient, and therefore it is necessary to investigate the effect of retraction of anterior teeth on pharyngeal airway.

The aim of this retrospective study was to evaluate the effect of maximum retraction of anterior teeth at each level of pharyngeal airway and hyoid bone position after extraction of four first premolars in bimaxillary protrusion adults.

Materials and method

Records of around 150 patients were searched in the institution but only 22 patients (09 males and 13 females) fulfilled our inclusion criteria. Therefore, the study was carried out on a selected patient sample only.

Inclusion criteria:

- Minimum age 17 years.
- Skeletal Class I, Class I molar, and canine relation.
- Well-aligned arches with no or minimal crowding.
- Protrusive lips and proclined anterior teeth with their value greater than 02 standard deviation above the normal mean value.
- Indication of therapeutic extraction of four first premolars.
- Indication of retraction of anterior teeth as a standard care of treatment.
- Group A anchorage.
- Maximum intercuspation of teeth.
- Good quality cephalograms.

Exclusion criteria:

- History of previous orthodontic/orthopedic treatment.
- History of cleft lip/palate, mouth breathing, permanent snoring, and tonsillectomy/adenoidectomy.
- Enlargement of tonsils or adenoids on lateral cephalogram.
- Teeth not in occlusion.

The mean preoperative age was 22.52 years with an overall range of 17–29 years. All patients underwent Roth 018 preadjusted edgewise appliance treatment with maximum anchorage reinforcement. There were only two types of anchorage reinforcements that were considered in this study.

(a). Nance button with vertical pull headgear – 19 cases.
(b). Transpalatal arch (TPA) with vertical pull headgear – 03 cases.

In these cases, second molars were also banded, and first and second molars were made as one unit bilaterally.

Vertical pull headgear was used for 14–16 h a day. Since it is not feasible for the patient to wear headgear for 24 h, additional anchorage in the form of TPA with banded second molars/Nance button was given to prevent anchorage loss during that time. Though some anchorage loss is still bound to happen, it will be minimal.

All pre- and post-treatment lateral cephalograms were standardized (same machine – Dimax-3, Planmeca Proline XC, same operator, linear magnification of 11%, and taken in end expiration).

The pharyngeal airway and hyoid bone were evaluated. The pharynx was divided into four levels – nasopharynx, velopharynx, glossopharynx, and hypopharynx. The cephalometric landmarks and analyses (Table 1, Fig. 1) for pharyngeal and hyoid bone were based on the methods described by Lowe et al.,[12] Liu et al.,[13] and Zhong et al.[14] The pre- and post-cephalograms for all the patients were traced on the acetate tracing paper by the same investigator. To check reproducibility error, the radiographs were again traced by the same investigator after 02 and 04 months. The mean differences were less than 1 mm and 1°. The standard error for each cephalometric value was calculated. Student's paired *t*-test[15] was used to determine systematic error and *P* value, for these