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Original Research

Effects of first premolar extraction on airway dimensions in young adolescents

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ABSTRACT:
Background: To study the effect of first premolar extraction on airway dimensions in young adolescents treated for bimaxillary proclination. **Materials & methods:** A total of 100 subjects were enrolled. Subjects with pre and post orthodontic treatment were considered. The age group taken to study was 13 to 19 years. Pre and post treatment lateral cephalograms were manually traced using acetate tracing paper carefully attached to the radiographs. Pearson's correlation coefficient was calculated to evaluate the reliability of observations. Data was collected and results were analysed using SPSS software. **Results:** Mean values of nasopharyngeal dimension and Total Airway Length (TAL) showed no statistically significant difference in pre and post treatment groups. All other airway parameters showed statistically significant difference. Pearson's correlation coefficient showed statistically significant correlations in all the airway parameters. **Conclusion:** The nasopharyngeal dimension (PNS-HP) and Total Airway Length (TAL) were not found to be directly affected by the retraction of anterior teeth.
Keywords: premolar extraction, adolescent, airway

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INTRODUCTION

Bimaxillary protrusion (BMP) is defined as a condition wherein the upper and lower incisors are protrusive or proclined, leading to lip protrusion, which mostly corresponds to bimaxillary dentoalveolar protrusion. [1] In a specific sense, bimaxillary skeletal protrusion (BSP) is characterized by protrusive upper and lower jaws with or without incisor proclination. [2] Most patients with skeletal and/or dentoalveolar protrusion are treated with microimplant anchorage for maximum anterior retraction after extraction of four premolars with the aim of esthetic improvement. [3,4]

Dental arch expansion is associated with airway dimensional changes. [5] The effect of extraction treatment will be reflected on the arch dimensions, and since most of the extraction spaces in patients with bimaxillary proclination would be used for incisor retroclination and correction of lip procumbency, it is imperative to assume that altering incisor and soft-tissue position and arch dimension could affect tongue position, and therefore, the upper airway dimensions. [6] This especially holds good in young adolescent growing patients who may be put to risk for airway incumbency.

It is well-accepted that, during orthodontic treatment involving the extraction of teeth, arch dimensional changes occur and that these dimensions continue to change following active treatment. [7] Quantification of these changes in the maxillary arch, however, has only recently been provided. [8] Hence, the study was conducted to show the effect of first premolar extraction on airway dimensions in young adolescents treated for bimaxillary proclination.

MATERIALS & METHODS

A total of 100 subjects were enrolled. Subjects with pre and post orthodontic treatment were considered. The age group taken to study was 13 to 19 years. Pre and post treatment lateral cephalograms were manually traced using acetate tracing paper carefully attached to the radiographs. Magnification of radiographs was corrected and calibrated according to the magnification factor and using the radiopaque ruler (calibration marker). All lateral cephalometric measurements were performed. Landmarks for sagittal airway measurements and hyoid bone position were identified for each cephalogram, yielding 11 linear measurements. Definition of the different landmarks and measurements used was considered. Pearson's correlation coefficient was calculated to evaluate the reliability of observations. Data was collected and results were analysed using SPSS software.

SOS- most inferior point of spheno- occipital synchondrosis

PNS- Posterior nasal spine

HP- Point of intersection of line from SOS to PNS on the posterior pharyngeal wall

BP- point of intersection of posterior pharyngeal wall and line PNS- Ba

TAL- vertical airway length

RESULTS

Descriptive statistics using paired t-test was used to assess changes in pre and post treatment values and Pearson's correlation coefficient was calculated to evaluate the reliability of observations. Mean values of nasopharyngeal dimension and Total Airway Length (TAL) showed no statistically significant difference in pre and post treatment groups. All other airway parameters showed statistically significant difference. Pearson's correlation coefficient showed statistically significant correlations in all the airway parameters.

Table1: Descriptive statistics, method error calculations and paired t test analysis for airway parameters.

Parameters	Pre treatment mean	Post treatment mean	P - value
PNS- HP	24.23	23.26	0.4
PNS- BP	26.43	25.11	0.005*
TAL	56.32	56.12	0.6

* : significant

Table2: Reliability of airway parameters using Pearson's correlation coefficient.

Parameters	Correlation (r)	P - value
PNS- HP	0.9	0.005*
PNS- BP	0.9	0.005*
TAL	0.9	0.005*

* : significant

DISCUSSION

Owing to the close relationship between the pharynx and the dentofacial structures, a mutual interaction has long been assumed and studies on the subject have been performed. [9]The upper airway in patients with retrognathism or prognathism with physiological breathing showed that the type of malocclusion did not influence the measurements of the airway. The transverse dimension of the nasopharynx is significantly decreased in patients with distoclusion. [10] Joseph et al. [11] assumed that skeletal factors, such as a retrognathic maxilla, can lead to narrowing of the anteroposterior dimensions of the airway. Furthermore, the study showed that hyperdivergent growth of the facial cranium or excessively vertical growth of the maxilla can result in narrowing of the anteroposterior dimensions of the airway.

In this study, descriptive statistics using paired t-test was used to assess changes in pre and post treatment values and Pearson's correlation coefficient was calculated to evaluate the reliability of observations. Mean values of nasopharyngeal dimension and Total Airway Length (TAL) showed no statistically significant difference in pre and post treatment groups. Various studies have demonstrated that changes in the hyoid position can result in changes to the mandibular position. It is reported that in patients with mandibular retrognathism, there was a posterior position of the hyoid associated with narrowing of the upper airway. [12] Abu Allhaija and Al-Khateeb[13] found a significant correlation between jaw relation, hyoid position and width of the pharyngeal cavity. Studies on the influence of surgical advancement or setback of the mandible on the hyoid position and the pharyngeal airway showed that mandibular advancement resulted in forward displacement of the hyoid with widening of the minimum pharyngeal airway (minimum pharyngeal airway: the minimal distance between the base of the tongue and the posterior pharyngeal wall), whereas the opposite was true in the case of the surgical mandibular setback. [14] In our study, all other airway parameters showed statistically significant difference. Pearson's correlation coefficient showed statistically significant correlations in all the airway parameters.

Chen et al. [15] reported a correlation between the retraction distance of the upper incisors and hypopharyngeal constriction in a cone-beam computed tomographic (CBCT) study, but their samples were irrelevant to the BSP population. Recently, Zheng et al. [16] found correlations among pressure, airflow, and pharyngeal cross-sectional reductions in BMP patients by performing a computational fluid dynamics study, but they did not address dentoskeletal risk factors. Interestingly, the present study suggested that the vertical skeletal change with clockwise mandibular rotation might be a risk factor for glossopharyngeal narrowing in BSP patients, as supported by multivariable linear regression analysis using the FH-MP as an independent variable adjusted for the sagittal skeletal relationship.

CONCLUSION

The nasopharyngeal dimension (PNS-HP) and Total Airway Length (TAL) were not found to be directly affected by the retraction of anterior teeth.

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