ORIGINAL RESEARCH

Retraction Effects on Upper Airway and Hyoid Bone Position in Class I Bimaxillary Dentoalveolar Protrusion Patients Treated with First Premolar Extraction

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ABSTRACT

Background: Bimaxillary protrusion is stated as a condition in which the upper and lower incisors are proclined and protrusive, which results in increased lip procumbency. The airway, also known as the respiratory tract, is a vital anatomical structure responsible for airflow during ventilation.

Materials & methods: A total of 20 patients with presence of Class I Bimaxillary Dentoalveolar Protrusion were enrolled. Complete demographic and clinical details of all the patients was obtained. All the subjects belonged to the age group of 18 to 28 years. Treatment planning was done. The treatment plan included the extraction of all first mandibular and maxillary premolars, followed by incisor retraction with fixed appliances and maximum anchorage. Landmarks were evaluated. All the results were assessed using SPSS software.

Results: Mean age of the patients was 21.5 years. Majority proportion of patients were males. Mean pretreatment and posttreatment H-RGN was 37.23 mm and 37.56 mm respectively. Mean pretreatment and posttreatment C3-H was 35.96 mm and 35.99 mm respectively. Mean pretreatment and posttreatment H1-H was 3.45 mm and 5.18 mm respectively. Significant improvement was seen in the position of hyoid bone post-treatment. Mean pretreatment and posttreatment SPP-SPPW was 14.96 mm and 13.19 mm respectively. Also; while evaluating the airway-dimension post-treatment in comparison to pre-treatment value, significant results were obtained.

Conclusion: The extraction of premolars accompanied by significant retraction in cases of bimaxillary protrusion may lead to a reduction in airway dimensions and a change in the vertical positioning of the hyoid bone.

Key words: Retraction, Airway, Bimaxillary, Dentialveolar

INTRODUCTION

Ischaemic stroke is characterized as the occurrence of Bimaxillary protrusion is stated as a condition in which the upper and lower incisors are proclined and protrusive, which results in increased lip procumbency. It is visible in almost every ethnic group although African–American and Asian populations frequently show this feature. Many patients with bimaxillary protrusion seek orthodontic treatment to reduce the procumbency because of the negative perception of protrusive dentition and lips.[1] The underlying cause of bimaxillary protrusion is multifactorial and includes genetic component along with environmental factors such as mouth breathing, tongue thrust, lip sucking habits, and tongue volume.[2] In a study reported by Keating, bimaxillary protrusion was found to be associated with shorter posterior cranial base, a longer and more prognathic maxilla and a mild Class II skeletal pattern. A smaller upper and posterior face height, diverging facial planes, and a procumbent soft tissue profile with low lip line seen in Caucasians was also shown by him. The main aim behind the orthodontic treatment of bimaxillary protrusion is to retract the maxillary and mandibular incisors with the resultant reduction in soft tissue procumbency and convexity which is brought about by extracting the four first premolars followed by the retraction of anterior teeth using maximum anchorage mechanics.[3]

The airway, also known as the respiratory tract, is a vital anatomical structure responsible for airflow during ventilation.[4] The airway is subdivided into two zones: the upper airway and the lower

airway.[5] Anatomically, the upper airway can be divided into three sections: nasopharynx, oropharynx, and laryngopharynx, which serve a vital function of human survival-breathing.[6] Among those, the oropharynx is the narrowest part of the airway. It is also the most predisposed to change during and or after the orthodontic treatment. Respiratory disorders such as obstructive sleep apnoea (OSA) can arise because of upper airway constriction.[5] Hence; the current research was conducted for assessing the efficacy of First Premolars' Extraction with Maximum Retraction on Airway and Hyoid Bone Position in Class I Bimaxillary Dentoalveolar Protrusion Cases.

MATERIALS & METHODS

The present study was conducted for assessing the efficacy of First Premolars' Extraction with Maximum Retraction on Airway and Hyoid Bone Position in Class I Bimaxillary Dentoalveolar Protrusion Cases. A total of 20 patients with presence of Class I Bimaxillary Dentoalveolar Protrusion were enrolled. Complete demographic and clinical details of all the patients was obtained. All the subjects belonged to the age group of 18 to 28 years. Treatment planning was done. The treatment plan included the extraction of all first mandibular and maxillary premolars, followed by incisor retraction with fixed appliances and maximum anchorage. However; patients on any history of orthopedic therapy or dentofacial anomalies were excluded from the present study. Lateral cephalograms were obtained in all the patients and were evaluated both pretreatment and posttreatment. All the radiographs were evaluated by single observer. Landmarks evaluated included- SPPW: Intersection of the line from the soft palate center perpendicular to the posterior pharyngeal wall, SPP: Intersection of the line from the soft palate center perpendicular to the posterior pharyngeal margin of the soft palate, U: Uvula, R: Intersection of line from horizontal to PNS and posterior pharyngeal wall, C3: Most anteroinferior potin of the third vertebrae, RGN: The most anterior point on retrognathion, H: The most anterosuperior point on hyoid bone and H11: Foot point perpendicular to line drawn from RGN to C3. The evaluation of airway dimensions was conducted through the following measurements: the distance from the posterior nasal spine to point R (R-PNS), the size of the pharyngeal airway at the soft palate and the posterior wall of the soft palate (SPP-SPPW), the distance from the uvula to the middle pharyngeal wall (U-MPW), the measurement from the tongue base to the posteroinferior point on the middle pharyngeal wall (TB-TPPW), and the distance from the vallecula to the lower pharyngeal wall (V-LPW). All the results were recorded in Microsoft excel sheet followed by statistical analysis using SPSS software.

RESULTS

Mean age of the patients was 21.5 years. Majority proportion of patients were males. Mean pretreatment and posttreatment H-RGN was 37.23 mm and 37.56 mm respectively. Mean pretreatment and posttreatment C3-H was 35.96 mm and 35.99 mm respectively. Mean pretreatment and posttreatment H1-H was 3.45 mm and 5.18 mm respectively. Significant improvement was seen in the position of hyoid bone post-treatment. Mean pretreatment and posttreatment SPP-SPPW was 14.96 mm and 13.19 mm respectively. Also; while evaluating the airway-dimension post-treatment in comparison to pre-treatment value, significant results were obtained.

Table 1: Comparison of change in position of hyoid bone after treatment

Parameter	Pre-treatment	Post-treatment	p-value
H-RGN (mm)	37.23	37.56	0.12
C3-H (mm)	35.96	35.99	0.88
H1-H (mm)	3.45	5.18	0.00*
S-H (mm)	106.21	110.82	0.00*

*: Significant

Table 2: Comparison of change in airway dimension after treatment

Parameter	Pre-treatment	Post-treatment	p-value
R-PNS (mm)	22.39	22.12	0.13
SPP-SPPW (mm)	14.96	13.19	0.00*
U-MPW (mm)	12.12	10.54	0.00*
TB-TPPW (mm)	13.85	11.17	0.01*
V-LPW (mm)	15.32	13.17	0.02*

*: Significant

DISCUSSION

Constriction of the oropharynx may lead to breathing problems during sleep, varying from minor problems like snoring to severe conditions such as obstructive sleep apnea (OSA). OSA is a chronic sleep-related respiratory dysfunction (SRRD) caused by airflow cessation due to a collapsed upper airway.[7] The patients suffering from OSA face severe problems during sleep, compromising their quality of life.[8] The literature shows that cases with OSA have distinct anatomical features like small airway caliber, posteriorly positioned tongue, and inferiorly positioned hyoid bone, all of which lead to problems in normal breathing.[9,10] Orthodontists can play a significant role in identifying the possible risk factors for SRRD in susceptible patients[11] and preventing further airway construction secondary to tooth movement. However, this requires careful assessment

of dentofacial features and malocclusion before deciding on the final treatment plan. One such malocclusion is the bimaxillary dentoalveolar protrusion. This malocclusion is characterized by incisor proclination beyond the esthetic range, requiring orthodontic force to retract them within an esthetic limit, which can most easily be achieved by extracting all first premolars and maximum incisor retraction.[12,13] This study was conducted to evaluate the Effect of First Premolars' Extraction with Maximum Retraction on Airway and Hyoid Bone Position in Class I Bimaxillary Dentoalveolar Protrusion Cases.

Mean age of the patients was 21.5 years. Majority proportion of patients were males. Mean pretreatment and posttreatment H-RGN was 37.23 mm and 37.56 mm respectively. Mean pretreatment and posttreatment C3-H was 35.96 mm and 35.99 mm respectively. Mean pretreatment and posttreatment H1-H was 3.45 mm and 5.18 mm respectively. Nagmode S et al[14] determined the effect of first premolar extraction on point A, point B and pharyngeal airway dimension in patients with bimaxillary protrusion. Materials and Methods: The following study included pre- and post-orthodontic treatment cephalograms of thirty bimaxillary protrusion patients. First premolars were extracted and all the cases were treated with maximum anchorage. Cephalometric radiographs were used to measure the changes in point A, point B, and pharyngeal airway dimensions. Pre- and post-treatment variables comparison was done using paired t-test and study of relationship between soft- and hard-tissue variables was carried out using linear regression equation. Results: In the results, there was a statistically significant increase in upper airway space ($P < 0.05$) and reduction in upper adenoid thickness ($P < 0.05$), tongue length ($P < 0.05$), and inferior airway space ($P < 0.05$). Retraction of mean point A and soft tissue point A (sA) was 3.3 mm ($P < 0.001$) and 2.1 mm ($P < 0.001$) and mean point B and soft tissue point B (sB) was 3.8 mm ($P < 0.001$) and 2.6 mm ($P < 0.001$), respectively. Between retraction of point A and soft tissue point A ($r = 0.9594$, $t = 101.84$, $P < 0.01$) and point B and soft tissue point B ($r = 0.9102$, $t = 83.246$, $P < 0.01$) a significant degree of correlation was seen to exist, along with lips retraction, retraction of the skeletal and soft tissue points A and B contributed to the decrease in hard and soft-tissue convexity. Conclusions: Upper airway space was increased which may be caused by lymphoid mass regression. Inferior airway space was reduced with the extraction of the first premolars for the treatment of bimaxillary protrusion. Retraction of Sa and Sb was brought about by retraction of skeletal point A and point B. Skeletal points and overlying corresponding soft tissue points showed nearly proportionate changes.

In the present study, significant improvement was seen in the position of hyoid bone post-treatment. Mean pretreatment and posttreatment SPP-SPPW was 14.96 mm and 13.19 mm respectively. Also; while evaluating the airway-dimension post-treatment in comparison to pre-treatment value, significant results were obtained.

CONCLUSION

The extraction of premolars accompanied by significant retraction in cases of bimaxillary protrusion may lead to a reduction in airway dimensions and a change in the vertical positioning of the hyoid bone. It is essential to conduct a thorough evaluation of the potential risk factors associated with obstructive sleep apnea (OSA), and to explore alternative treatment strategies for patients identified as high-risk.

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