***Original Research Article***

**Cephalometric Evaluation of Soft Tissue Changes with Extraction of all First Premolars among the Patients having Bimaxillary Protrusion attending in the Orthodontics Department of BMU**

**ABSTRACT**

***Objective****: Cephalometric evaluation of soft tissue changes with extraction of all first premolars among the patients having bimaxillary protrusion attending in the orthodontics department of BMU.* ***Methods:*** *It was an analytical prospective study carried out in the Department of Orthodontics, BMU among the patients having clinically diagnosed Bimaxillary protrusion cases. The following information was recorded from each patient’s clinical record: age at start of treatment, sex, duration of treatment in months, and extraction pattern. Pre- and post-treatment cephalometric radiographs was analyzed by Cephalometric Tracing. Analysis of both the pre- and post-treatment radiographs included 6 linear and angular measurements. The mean, range, and standard deviation (SD) was determined for each of the pre-treatment measurements. The treatment results were analyzed in the following parameters by measuring the changes between the pre and post-treatment cephalograms: Upper incisor position (U1-APog), Lower incisor position (L1-APog), Lower anterior face height, Upper lip position (UL-E), Lower lip position (LL-E) and Nasolabial angle (NLA). For the purpose of error testing, pre- and post-treatment cephalograms were traced at the same time, and all radiographs were traced by the same operator. The tracings were analyzed, and the differences in measurements between the two different tracings of the same radiograph was calculated. Paired t-tests was performed to determine the significant differences between the two tracings. The cephalometric values from the pre- and post-treatment cephalograms were evaluated by paired t-test. The pair t-test was used for assessing the effectiveness of treatments by using related data.* ***Results:*** *The mean change and SD for each measurement are listed along with associated P values as determined by paired t-tests. A reduction in the measurements is represented by a negative value, whereas an increase is represented by a positive value. The upper lip was retracted an average of 3.58 mm, and the lower lip was retracted an average of 1.83 mm. The naso-labial angle showed greater differences from a pre-treatment mean value of 81.07º to 89.67 degree with a mean difference of 8.59 degree. All these changes were found to be statistically significant (P<0.001). Whereas, Lower anterior face height changes 1.21 mm.* ***Conclusion:*** *Cephalometric standards were developed for bimaxillary protrusion, clarifying the overall presentation of this malocclusion for clinicians. In addition to the increased incisor proclination and protrusion inherent to this malocclusion, patients with bimaxillary protrusion tend, on average, to demonstrate a vertical facial pattern, a decreased nasolabial angle. The results of this study also showed that the extraction of four premolars can be extremely successful in reducing the soft tissue procumbence seen in patients with bimaxillary protrusion. This provides a stronger evidence-based rationale for this treatment modality.*

***Key words:*** *Extraction; Premolars; Bimaxillary; Protrusion; Profile.*

**Introduction**

Orthodontic treatment aims to resolve dento-skeletal problems and to achieve the ideal occlusion, functional stability and facial and dental aesthetic harmony [1]. Individuals often complain about unpleasant facial aesthetics and search for orthodontic treatment that is intended to restore balance to the facial profile, especially in protrusion cases [2]. Bimaxillary protrusion, or bimaxillary dentoalveolar protrusion, is defined as the proclination and protrusion of maxillary and mandibular anterior teeth with molar teeth in a Class I Angle relationship. Usually, this is indicated by an increase in the procumbency of the lips and a convex facial profile, where the upper and lower lips are incompetent or Gummy smile. Consequently, patients complain about the unpleasant aesthetic [3,4].The etiology of bimaxillary protrusion is multifactorial and consists of a genetic component as well as environmental factors, such as mouth breathing, tongue and lip habits, and tongue volume [5]. There is a paucity of information in the literature in terms of the overall characteristics of this malocclusion. However, in one of the few studies of its kind, Keating [6] used cephalometrics to determine the morphological features of bimaxillary protrusion in a strictly Caucasian population. He reported that bimaxillary protrusion was associated with a shorter posterior cranial base, a longer and more prognathic maxilla, and a mild Class II skeletal pattern. He also showed that this condition displayed a smaller upper and posterior face height, diverging facial planes, and a procumbent soft tissue profile with a low lip line. Soft tissue changes after upper premolar extraction in Class II camouflage therapy. The maxillary first premolar extraction for orthodontic camouflage may be a viable treatment option, especially if the patient has full upper lips and only a relative mandibular deficiency. Extraction of upper first premolars in patients with class ΙΙ div 1 malocclusion resulted in normal position of lips as presented by Holdaway, Legan and Ricketts which play a role in aesthetic profile. However, the amount of lip retraction was different from patient to patient [7]. In Bangladesh as per as possible we know that single study has been conducted regarding soft tissue changes after premolar extraction. The study was cephalometric evaluation of soft tissue changes after orthodontic treatment with extraction of upper first premolars in class II div-I cases of Bangladeshi population by Quayum [8]. To best of my knowledge, no study on such title ‘Cephalometric Evaluation of Soft Tissue changes after extraction of all first premolars in Bimaxillary protrusion cases’ has yet been found in Bangladesh. The current study will help to evaluate soft tissue changes after extraction of all first premolars in bimaxillary protrusion and compare pre and post treatment cephalometric measurements which will be beneficial to diagnosis, treatment planning of orthodontic patients. Thus, this study may provide valuable guideline in diagnosis and treatment planning.

**Materials And Methods**

**Study design, place and duration:** It was an analytical prospective study carried out from February 2019 to March 2020 at Department of Orthodontics, BMU, Dhaka, **Study Population:** Patients who were underwent fixed orthodontic treatment in the Department of Orthodontics, BMU. **Study sample:** Lateral cephalogram of the patients with bimaxillary protrusion. Purposive sampling procedure was taken. Sample size was 42. **Sampling method:** The participants were selected by criterion purposive sampling method which were fulfilled the predetermined selective criteria. The samples were included patients who are seeking orthodontics treatment in Orthodontics Department of BMU.

**Selection criteria**

**Inclusion Criteria**

* Patients having bimaxillary dental protrusion i.e. Proclined upper and lower labial segments and procumbent protrusive lips.
* Increase vertical dimensions or long-face patients.
* Patients requiring 1st 4 premolars extractions for orthodontic treatment.
* Age of the patients were14 to 30 years.

**Exclusion Criteria**

* Patients having functional appliance or orthognathic surgical procedure between pre- and post- treatment lateral cephalometric radiographs.
* Patients having congenitally missing teeth (excluding 3rd molars).
* Patients having craniofacial disorder or malformations.
* Patients having facial asymmetries.
* Patients having history of previous orthodontic treatment.
* Patients having history of trauma to maxillofacial structures.
* Patients having abnormal masticatory muscular pattern.
* Patients have history of congenital deformity like cleft lip and palate.
* Orthodontics patients with distorted lateral cephalogram.

**Study procedures**

The test sample was lateral cephalogram prescribed for routine orthodontic treatment of patients those were selected using predetermined exclusion and inclusion criteria. After obtaining informed written signed consent form the patient lateral cephalograms were collected from the patient attending orthodontic department of BMU. A total of 42 patients of 14 to 30 years old was enrolled in the study. Patient was Bangladeshi origin. Purposively 42 samples were selected. The pretreatment and the post-treatment lateral cephalometric films of a same patient was mounted on a light box. An acetate sheet was placed on top of the X-ray film, Upper incisor position (U1-APog), Lower incisor position (L1-APog), Lower anterior face height, Upper lip position (UL-E), Lower lip position (LL-E), Nasolabial angle (NLA) was traced by 2H pencil to evaluate cephalometric changes of soft tissue after extraction of all first premolars in Bimaxillary protrusion cases among the patient attending Orthodontic Department of BMU.

# Data management and analysis plan

# After collection of data, it was checked for any discrepancy and incompleteness. A data base was prepared by using SPSS for windows version 27.0, Chicago, 22 USA. After completion of data collection, it was entered in database one by one. It was further checked by descriptive statistics for presence of any missing or abnormal values on the data. A data file was prepared after re-checked in hard and soft copy and contacted with patients as necessary. After consideration of all issues data were ready for final analysis. Arithmetic mean and standard deviation of each variable was calculated. After data collection normality test was done. Unpaired student t-test was done between male and female subjects. Paired t-test was performed to compare pre- and post-treatment changes cephalometric measurement. This difference represented the effect of treatment. All of the statistical analysis was performed using specialized statistical software SPSS for Windows, Version 27.0, Chicago, 27, USA. A p-value less than 0.05 considered as significant level.

# Ethical considerations

Prior to the commencement of this study, ethical approval by the Institutional Review Board (IRB) of BMU was taken.

**Results**

**Table-1: Test showing mean age of distribution between male and female respondents (n=42) at start of treatment.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Age (years) | Male  (n=21)  No. (%) | Female  (n=21)  No. (%) | Total  (n=42)  No. (%) | p-value |
| 14-19 yrs | 12(57.1%) | 16(76.2%) | 28(66.7%) | 0.238ns |
| 20-25 yrs | 9(42.9%) | 5(23.8%) | 14(33.3%) |
| Total | 21(100.0%) | 21(100%) | 42(100.0%) |
| Mean±SD | 19.1±3.5 | 17.9±2.7 | 18.5±3.1 |
| Range | 14 – 25 | 14 – 24 | 14 – 25 |

Unpaired t-test, ns= not significant

The mean age of male patient was 19.1±3.5 years and for female 17.9±2.7 years. Minimum age 14 and maximum 25 years. There was no significant difference of mean age between male and female patients.

**Table-2: Cephalometric changes after Orthodontics correction of bimaxillary protrusion.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables | Soft tissue cephalometric measurement | | Mean change(post-pre) | p-value |
| Pre-treatment  (n=42)  Mean±SD | Post-treatment  (n=42)  Mean±SD |
| Upper incisor position (U1-APog) | 16.67±4.63 | 11.67±2.24 | -5.00 | <0.001\* |
| Lower incisor position (L1-APog) | 12.00±±4.75 | 8.08±1.71 | -3.92 | <0.001\* |
| Lower anterior face height | 77.17±6.54 | 75.95±5.53 | -1.21 | 0.484ns |
| Upper lip position (UL-E) | 3.00±3.08 | -0.58±2.65 | -3.58 | <0.001\* |
| Lower lip position (LL-E) | -1.33±4.36 | -3.17±1.97 | -1.83 | 0.010\* |
| Nasolabial angle (NLA) | 81.07±3.13 | 89.67±13.21 | 8.59 | <0.001\* |

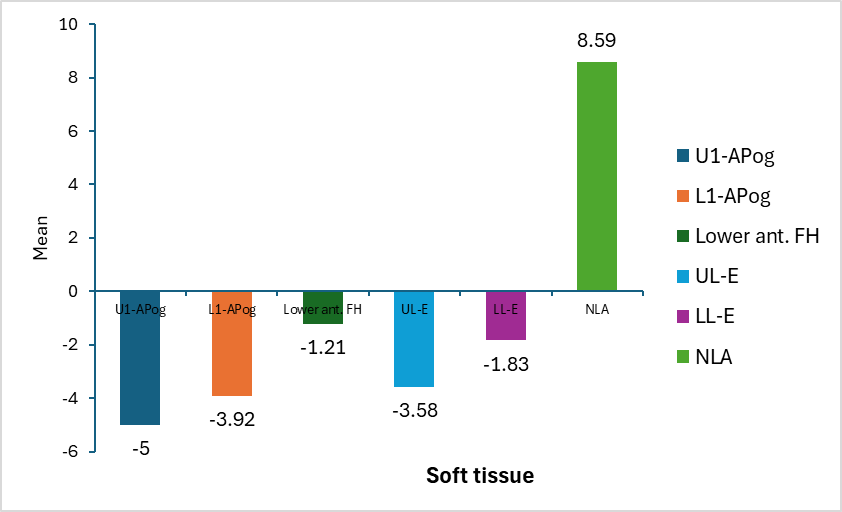
Data were expressed as mean±SD

Paired t-test was done to compare the variables

𝑃 ≥ 0.05 –nonsignificant (NS), \* 𝑃 ≤ 0.05 significant

To determine the overall effect of the orthodontic correction of bimaxillary protrusion, the changes between pre-treatment and post-treatment cephalometric radiographs were determined and are given in Table 2. The mean change and SD for each measurement are listed along with associated P values as determined by paired t-tests. A reduction in the measurements is represented by a negative value, whereas an increase is represented by a positive value. The upper lip was retracted an average of 3.58 mm, and the lower lip was retracted an average of 1.83 mm. The naso-labial angle showed greater differences from a pre-treatment mean value of 81.07º to 89.67 degree with a mean difference of 8.59 degree. All these changes were found to be statistically significant (P<0.001). Whereas, Lower anterior face height changes 1.21 mm, which was not statistically significant.

**Mean Change of soft and hard tissue parameters from pre-treatment to post-treatment**



***Figure-1****: Mean Change of soft tissue parameters from pre-treatment to post-treatment*

**Discussion**

The investigations in our study mostly depended on pre- and post treatment hard tissue and soft tissue lateral cephalometric analysis. In our study, selected all patients had suffered procumbent lips and associated dento-alveolar protrusion. The majority our patients complained mainly of prominent protruded incisors and lips. However, Facial attractiveness is due to individual perception. It has no standard perception, and an attractive face perceived by the public may not match the average persons face. We have concentrated mostly on the soft tissue profile changes. In present study determine the overall effect of the orthodontic correction of bimaxillary protrusion, the changes between pretreatment and posttreatment cephalometric radiographs were determined. The mean change and SD for each measurement are listed along with associated P values as determined by paired t-tests. A reduction in the measurements is represented by a negative value, whereas an increase is represented by a positive value. The upper lip was retracted an average of 3.58 mm, and the lower lip was retracted an average of 1.83 mm. All these changes were found to be statistically significant (P<0.001). Whereas, Lower anterior face height changes 1.21 mm, which was not statistically significant. The naso-labial angle showed greater differences from a pre-treatment mean value of 81.07º to 89.67 degree with a mean difference of 8.59 degree. Our findings agree with the results of Sukhia et al [9]. who reported the naso-labial angle showed greater differences from a pre-treatment mean value of 86.2º to 90.4º with a mean difference of 4.º Lo and Hunter [10] reported that the greater the maxillary incisor retraction the greater the increase in the naso-labial angle. In this study, this ratio for the upper lip was 3.12:1 (11.17 mm of upper incisor retraction to 3.58 mm of upper lip retraction). This result is similar to those of Bills et al. [4], Chiasson and Hershey [11,12], who found ratios of 2.2:1, 2.2:1 and 2:1, respectively, but it is less than the 3:1 ratio reported by Diels et al [13]. These results, together with the significant increase in nasolabial angle seen in these patients (P<0.001), suggest that the extraction of four premolars can be effective in decreasing the soft tissue procumbency in patients with bimaxillary protrusion. However, the large SD, which accompany the mean changes in lip position, as well as the varying ratios of incisor retraction to lip retraction reported in the literature, suggest a great deal of variability in the soft tissue response. No significant difference was found between the pre- and posttreatment measurements of lower anterior face height. These results suggest that the mechanics used in the treatment of individuals with bimaxillary protrusion have no significant effect on the vertical dimension.

**Conclusions**

* Cephalometric standards were developed for bimaxillary protrusion, clarifying the overall presentation of this malocclusion for clinicians.
* In addition to the increased incisor proclination and protrusion inherent to this malocclusion, patients with bimaxillary protrusion tend, on average, to demonstrate a vertical facial pattern, a decreased nasolabial angle.
* The results of this study also showed that the extraction of four premolars can be extremely successful in reducing the soft tissue procumbence seen in patients with bimaxillary protrusion. This provides a stronger evidence-based rationale for this treatment modality

**References**

1. Kasmawaricin K, Harahap N, Oeripto A. Lower facial height and soft tissue changes in bimaxillary protrusion cases. Scientific Dental Journal. 2019 Jan 31;3(1):1-7.
2. Mattos CT, Marquezan M, Chaves IB, Martins DG, Nojima LI, Nojima MD. Assessment of facial profile changes in Class I biprotrusion adolescent subjects submitted to orthodontic treatment with extractions of four premolars. Dental Press Journal of Orthodontics. 2012; 17:132-7.
3. Aslin SA. Soft tissue profile changes following treatment with all four first premolars in bimaxillary protrusion cases–Research article. *IOSR-JDMS*, 2015; *14*(10): 70-72.
4. Bills DA, Handelman CS, BeGole EA. Bimaxillary dentoalveolar protrusion: traits and orthodontic correction. The Angle Orthodontist. 2005 May;75(3):333-9.
5. Lamberton CM, Reichart PA, Triratananimit P. Bimaxillary protrusion as a pathologic problem in the Thai. American journal of orthodontics. 1980 Mar 1;77(3):320-9.
6. Keating PJ. Bimaxillary protrusion in the Caucasian: a cephalometric study of the morphological features. British journal of orthodontics. 1985 Oct;12(4):193-201.
7. Amirabadi GE, Mirzaie M, Kushki SM, Olyaee P. Cephalometric evaluation of soft tissue changes after extraction of upper first premolars in class ΙΙ div 1 patients. Journal of clinical and experimental dentistry. 2014 Dec;6(5): e539.
8. Quayum, F.B. Cephalometric evaluation of Dentofacial and soft tissue changes after orthodontic treatment with extractin of upper first premolars in class II div-I cases of Bangladeshi population. FCPS-II Dissertation, BCPS, 2015.
9. Sukhia RH, Sukhia HR and Mahdi S. Soft Tissue Changes with Retraction in Bi-Maxillary Protrusion Orthodontic Cases. *Pakistan Oral & Dental Journal*, 2013; *33*(3): 1-6.
10. Lo FD, Hunter WS. Changes in nasolabial angle related to maxillary incisor retraction. American journal of orthodontics. 1982 Nov 1;82(5):384-91.
11. Chiasson RC. Soft Tissue Changes in Black Orthodontic Patients [master’s thesis]. Chicago, Ill: University of Illinois at Chicago, 1996.
12. Hershey HG. Incisor tooth retraction and subsequent profile change in post adolescent female patients. American Journal of Orthodontics. 1972 Jan 1;61(1):45-54.
13. Diels RM, Kalra V, DeLoach Jr N, Powers M, Nelson SS. Changes in soft tissue profile of African-Americans following extraction treatment. The Angle Orthodontist. 1995 Aug;65(4):285-92.