

ORIGINAL RESEARCH

Soft Tissue Changes Associated with First Premolar Extractions in Kashmir Female Population

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ABSTRACT

Purpose: The purpose of study was to examine the effect of upper and lower incisor retraction on reduction of the profile and to record any correlation between dental and soft tissue parameters.

Materials and methods: The study was a retrospective cephalometric study. A homogenized sample of 10 adult female orthodontic patients was selected from the local population. All patients were treated at a private practice using Pre Adjusted 0.022" slot edgewise appliance. Pretreatment and post-treatment lateral cephalograms were taken in natural head position with lips in relaxed position. Each lateral cephalogram was traced and a reference line was established (a constructed line perpendicular to Sella-Nasion minus 7° through Sella). Linear measurements were made with a from A' point, upper incisor tip, mandibular incisor tip, most anterior point of upper lip, most anterior point of lower lip and B' point. The angular measurements were the nasolabial angle, labiomental angle. Upper and lower lip thickness and interlabial gap parallel to the reference line were also measured.

Results: All linear and angular measurements showed statistically significant ($p < 0.05$) changes except for changes in upper lip thickness, lower lip thickness, lower vermillion, B' point and lower lip anterior. The Pearson's correlation test showed a significant positive correlation between upper incisor retraction and upper lip position statistically significant decrease in the interlabial gap by 3.4 ± 2.5 mm ($p < 0.001$).

Conclusion: On the basis of the results obtained from this study, it can be concluded that extraction of the four first premolars followed by the retraction of anteriors can be successful in reducing dental and soft tissue procumbency in adult females with bimaxillary protrusion in the local population.

Keywords: Bimaxillary protrusion, Corrective orthodontics, Kashmiri population, Lip retraction.

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INTRODUCTION

Contemporary orthodontics places the achievement of pleasing facial esthetics as one of the primary objectives of treatment. Facial esthetics is equally influenced by the underlying hard tissues and the response of the overlying soft tissue drape to the position of the hard tissues. Both of the above differ significantly among various ethnic groups and races, and hence a list of norms acceptable for one race or ethnic background may not be acceptable for another.

Bimaxillary protrusion is an excessive forward projection of both the maxilla and the mandible in relation to the cranial base.¹ In his seminal paper in 1945, Tweed argued that the extraction of four premolars is needed in more than 50% of cases to achieve anatomic and physiologic goals of treatment. Favorable soft tissue changes and successful orthodontic correction of bimaxillary protrusion has been reported where treatment involved the extraction of the four first premolars.¹⁻³

Orthodontists have long recognized that the extraction of premolars is often accompanied by changes in the soft tissue profile and although many studies have evaluated the relationship between incisor movement and soft tissue profile changes.⁴⁻⁷

Cephalometric analysis help in guiding in diagnosis and tooth movement decisions.⁸⁻¹⁰ It has been used as the standard because of the ease of procuring, measuring, and comparing (superimposition) hard tissue structures and the belief that treating to cephalometric hard tissue norms results in a pleasing face. These perceived advantages of cephalometric analysis have led to heavy reliance on cephalometry in all aspects of orthodontic treatment.

This study examines the effect of first premolar extraction and the retraction of anterior teeth on the reduction of the soft tissue bimaxillary protrusion in adult females of a local population. The increased prevalence of bimaxillary protrusion and the lack of baseline data regarding possible treatment changes make the information to be obtained from this study of utmost importance.

Keeping these facts in mind, the study was based on the following objectives:

- To examine the effect of upper and lower incisor retraction on reduction of the profile.
- To record any correlation between dental and soft tissue parameters.

MATERIALS AND METHODS

The study was a retrospective study. A homogenized sample of 10 adult female orthodontic patients was selected from the local population.

The selection criteria for these patients were as follows:

- Adult females with Class I bimaxillary protrusion.
- Mean mandibular plane angle of 29.2°.
- Mean age of 18.2 years to reduce growth effects.
- All patients underwent first premolar extractions.

All patients were treated by at a private practice (Braces and Bridges Orthodontic Center) using Pre-Adjusted 0.022" slot edgewise appliance.

Pre- and post-treatment lateral cephalograms were taken in natural head position with lips in relaxed position. Each lateral cephalogram was traced and a reference line was established (a constructed line perpendicular to Sella-Nasion minus 7° through Sella).

Linear measurements were made with a millimeter ruler from A' point, upper incisor tip, mandibular incisor tip, most anterior point of upper lip, most anterior point of lower lip and B' point (Fig. 1).

The angular measurements made were the Nasolabial angle, Labio-mental angle (Fig. 2).

Upper and lower lip thickness and interlabial gap parallel to the reference line were also measured (Fig. 3).

STATISTICAL ANALYSIS

All the values obtained were stored in a Microsoft Excel Spreadsheet. Changes occurring during treatment were

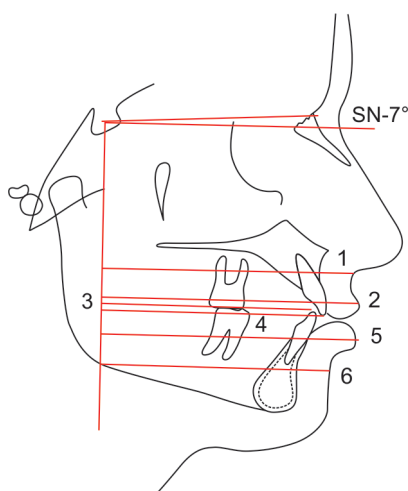


Fig. 1: Linear measurements to reference line: (1) A' point, (2) anterior most point of upper lip, (3) lower incisor tip, (4) maxillary incisor tip, (5) anterior most point on lower lip and (6) B' point

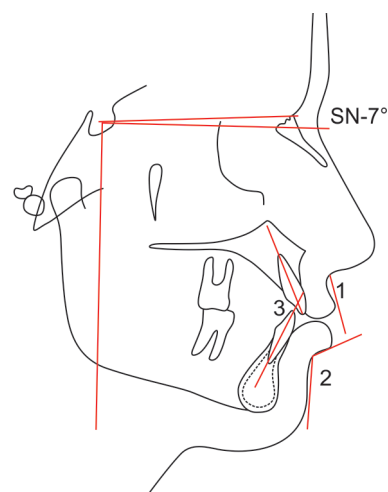


Fig. 2: Angular measurements: (1) Nasolabial angle, (2) labiomental angle and (3) Inter-incisal angle

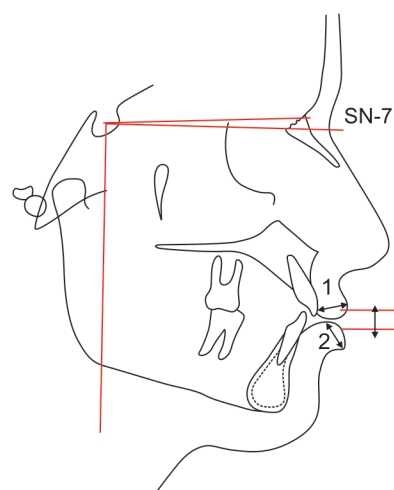


Fig. 3: Measurements to reference line: (1) Upper lip thickness and (2) lower lip thickness

calculated and data analyzed using minitab statistical software (Version 14).

Levels of significance (p-values) were calculated using the students paired t-test. Pearson's correlation coefficient (r) was calculated to evaluate the correlation between the hard and soft tissues. Stepwise regression analysis was done to obtain the ratios between dental and soft tissue structures.

RESULTS

- All linear and angular measurements showed statistically significant ($p < 0.05$) changes except for changes in upper lip thickness, lower lip thickness, lower vermilion, B' point and lower lip anterior (Table 1).
- The Pearson's correlation test showed a significant positive correlation between upper incisor retraction and upper lip position ($r_{U1-0.79}$) (Table 2).
- Statistically significant decrease in the interlabial gap by 3.4 ± 2.5 mm ($p < 0.001$).
- Stepwise multiple regression analysis showed that

Table 1: Results of t-test between pre- and post-treatment values

Measurement		Pre	Post	Change	p-value
Nasolabial angle	Mean	83.9	99.5	15.6	<0.001
	SD	13.4	13.4	6.5	
Labiomental sulcus	Mean	86.0	97.0	11.0	<0.05
	SD	18.3	12.5	15.2	
U lip thickness	Mean	12.8	13.3	0.5	0.16
	SD	1.5	1.0	0.9	
L lip thickness	Mean	14.5	14.7	0.2	0.22
	SD	1.3	1.4	0.5	
Pt A'	Mean	84.6	83.4	-1.2	<0.05
	SD	3.8	4.1	1.0	
U lip anterior	Mean	90.5	87.7	-2.8	<0.001
	SD	4.7	5.1	1.2	
L lip anterior	Mean		84.8	-1.8	<0.05
	SD		5.8	1.8	
Pt B'	Mean		74.2	-1.1	0.08
	SD		6.3	1.7	
Interlabial gap	Mean		3.1	-3.4	<0.001
	SD		2.0	2.5	
Upper incisor	Mean		73.9	-5.3	<0.001
	SD		5.0	2.6	
Lower incisor	Mean		71.8	-3.7	<0.05
	SD		5.2	4.3	

Table 2: Pearson's correlation between hard and soft tissue changes

	Maxillary incisor changes		Mandibular incisor changes	
	(r)	(p)	(r)	(p)
Nasolabial angle	-0.63	<0.05	-	-
Mentolabial sulcus	-	-	-0.42	0.22
Upper lip vermillion	0.25	0.49	-	-
Lower lip vermillion	-	-	-0.01	0.98
Upper lip anterior	0.79	<0.01	-0.10	0.81
Lower lip anterior	0.114	0.76	0.34	-0.33

- For every 1 mm of upper incisor retraction, 0.049 mm retraction of the anterior most point of the upper lip occurred.
- For every 1 mm of lower incisor retraction, 0.052 mm retraction of the anterior most point of the lower lip occurred.
- For every 1 mm of maxillary incisor retraction the nasolabial angle increased by 2.68°.
- For every 1 mm of mandibular incisor retraction the labiomental angle increased by 3.16°.

DISCUSSION

The assessment of horizontal changes in dentoskeletal and soft tissue relationships in this study was performed with the use of a reference line through Sella, perpendicular to Sella-Nasion minus 7°, a technique commonly used to approximate true horizontal and minimize variability.

The changes recorded in this study were purely as a result of treatment. The confounding changes occurring

due to growth and any difference in interpretation of values due to sex variance were eliminated by a selection of a homogenized sample consisting of adult females (Mean age = 18.2 years).

When treating malocclusions characterized by bimaxillary protrusion it is desired that the upper and lower lips move back and the nasolabial and mentolabial angles increase, reducing the procumbency of the profile.¹¹

The major finding in this study was the reduction in upper and lower lip procumbency. Horizontal changes in the positions of the upper lip were associated with incisor retraction.¹² This was in agreement with various studies^{6,13} evaluating incisor retraction and response of the upper lip to this incisor retraction. The upper incisors were retracted by a mean of 5.3 ± 2.6 mm (p < 0.001). The mean retraction of the upper lip was 2.89 ± 1.2 mm (p < 0.05). An upper lip to incisor retraction ratio of 1:2.31 was observed. Studies in Caucasians have reported ratios for upper lip to incisor retraction as ranging from 1:1.6 to 1:3.8.¹⁴ The ratio obtained in our study was similar to that obtained by Conley and Jernigan¹⁵ which was 1:2.68 where the mean incisor retraction was 5.27 mm. In a study of white males, Waldman¹⁶ showed an upper lip to incisor retraction ratio of 1:3.8.

In bimaxillary protrusion, the lower lip most often contacts both the lower and the upper incisors, therefore, the position of the lower lip would be influenced not only by the retraction of the lower incisors but retraction of the upper incisors as well.¹⁴ The mean lower incisor retraction in this study was 3.7 ± 4.3 mm (p < 0.001). The ratio of lower lip to lower incisor retraction was 1:2.07. There was a significant reduction in the procumbency of the lower lip with retraction of the incisors. This supported the findings of Xu et al,¹⁷ who showed that premolar extractions decrease lower lip and soft tissue B' point prognathism.

Review of the nasolabial soft tissue is important when contemplating orthodontic treatment. Movement of the maxillary incisors in any one of the three planes of space influences this area.^{5,6,18,19} In this study, retraction of the upper lip and upper incisors lead to a significant increase in the nasolabial angle by 15.6 ± 6.3° (p < 0.001). There was a high negative correlation of the nasolabial angle with the retraction of the incisors. For every 1 mm of incisor retraction the nasolabial angle increased by 2.68°. This value was relatively higher than that obtained by Lo and Hunter (1:1.63°)⁵ and Talass et al (1:0.8°).²⁰ The possibility for this variation is the difference in the mean amount of incisor retraction in each study. This study showed a significant change in the nasolabial angle in relation to the horizontal movement of the incisor edge, however, this was unlike the results obtained by Waldman¹⁶ who stated that the nasolabial angle increased with uprighting

of the incisor and the relationship of the horizontal movement of the Incisal edge and nasolabial angle was unpredictable.

The labiomental angle also showed a significant reduction by $11 \pm 1.3^\circ$ ($p < 0.05$), thereby improving the profile of patients as shown by De Smit and Dermaut²⁰ who also suggested that the labiomental angle plays an important role in esthetic evaluation. However, Bravo²¹ noticed that changes in the labiomental angles were not significant as compared to other parameters of soft tissue. In this study for every 1 mm of lower incisor retraction, the labiomental angle increased by 3.08° .

Oliver⁷ in his study had observed that significant correlations were found between incisor changes and the vermilion border of lip in females and the correlation was stronger in individuals with higher lip strain and thin lips. In this study, also it was deduced that lip structure and morphology has an influence on upper lip response and it was noticed that patients with thinner lips showed a significantly greater lip fall than those with thicker lips.

The study also noted a statistically significant decrease in the interlabial gap by 3.4 ± 2.5 mm ($p < 0.001$). This may be contributed to by the retraction of the upper and lower incisors and a subsequent increase in the interincisal angle. A similar correlation was reported by Jacobs.¹⁹

As expected this study was consistent with a number of authors in showing that premolar extraction followed by incisor retraction does cause favorable soft tissue changes and assists in reducing the procumbency of the facial profile in individuals with class I bimaxillary protrusion.

CONCLUSION

From the results obtained in this study, the following conclusions can be drawn:

- Extraction of the first premolars followed by incisor retraction leads to the following favorable soft tissue profile changes
 - Significant posterior movement of the upper and lower lips thus, reducing lip procumbency.
 - Significant increase in the nasolabial and labiomental angles leading to an improvement in profile.
- A strong correlation exists between maxillary incisor change and upper lip changes for this sample showing that upper lip changes were more predictable. However, the soft tissue changes may be also dependant of soft tissue morphology and underlying skeletal foundation.
- On the basis of the results obtained from this study, it can be concluded that extraction of the four first premolars followed by the retraction of anteriors

can be successful in reducing dental and soft tissue procumbency in adult females with bimaxillary protrusion in the local population.

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