

# The Soft Tissue Changes Following Orthodontic Treatment of Bimaxillary Protrusion (A Clinical and Photographical Study)

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## ABSTRACT

**Background:** Bimaxillary protrusion is considered as one of the most important causes to seek the orthodontic treatment to get better esthetics. This study aimed to test the effect of orthodontic treatment in improvement the facial esthetics.

**Materials and Methods:** Ten Iraqi Arab females having bimaxillary protrusion based on Class I malocclusions treated with fixed orthodontic appliance and extraction of the maxillary and mandibular 1<sup>st</sup> permanent premolars. Pre and post-treatment facial profile photographs were taken for each patients and the effect of treatment was tested in comparison with the pre-treatment photographs by using seven angular measurements.

**Results:** After treatment, the upper and lower lip projections were decreased significantly, the naso-labial and mento-labial angles were increased significantly.

**Conclusion:** Treatment of bimaxillary protrusion with fixed orthodontic appliances and extraction of four premolars improve the facial esthetics of the patients by decreasing the lip projection and increasing the naso-labial and mento-labial angles.

**Key words:** Bimaxillary protrusion, facial esthetics, photographs. (J Bagh Coll Dentistry 2016; 28(1):133-137).

## INTRODUCTION

Bimaxillary dentoalveolar (Bialveolar) protrusion is defined as an anterior position and labial inclination of the maxillary and mandibular incisors with respect to their supporting bones and the facial profile <sup>(1)</sup>.

Patients with bimaxillary protrusion demonstrated increased incisor proclination and protrusion, a vertical facial pattern, increased procumbency of the lips, a decreased nasolabial angle, thin, elongated upper and lower anterior alveoli <sup>(2-4)</sup>.

Bimaxillary protrusion is seen commonly in African-American and Asian population, but it can be seen in almost every ethnic group. Because of the negative perception of protrusive dentition and lips in most cultures, many patients with bimaxillary protrusion seek orthodontic care to decrease the procumbency <sup>(5-8)</sup>. The etiology of bimaxillary protrusion is complex involving environmental factors, genetic component, soft-tissue function, volume and habit <sup>(9)</sup>.

The goals of orthodontic treatment of bimaxillary protrusion include the retraction of both maxillary and mandibular incisors to decrease soft tissue procumbency and facial convexity. The extraction treatment has gained the popularity due to its greater long-term stability and greater esthetic changes after treatment especially in those cases where there is dentoalveolar protrusion.

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The common treatment approach involves extraction of first four premolars with maximum anchorage mechanics <sup>(8)</sup>.

In Iraq, Ismael <sup>(10)</sup> identifies the cephalometric features of bimaxillary protrusion in ninety four Mosul adolescents with class I normal occlusion.

The present study aimed to demonstrate the effect of orthodontic treatment on the facial profile of bimaxillary protrusion cases.

## MATERIALS AND METHODS

### Sample

Ten female patients with an age ranged between 17-22 years, had bimaxillary dentoalveolar protrusion based on Class I Angle' classification malocclusion were selected in this study. All of them were white Iraqi Arab in origin and had full permanent dentition regardless the wisdom teeth with minimal crowding (1-2mm.).

### Methods

Standardized profile photographs with Frankfort plane horizontal using Canon Power shot SD750 digital Elph (7.1 Megapixel, Japan) camera with a 100 cm distance from the patient were taken prior to the orthodontic treatment.

After dental extraction of the maxillary and mandibular first permanent premolars, Roth stainless steel brackets (Bionic, Orthotechnology Co., USA) with 0.022" slot were bonded on the maxillary and mandibular teeth using no-mix orthodontic composite (Orthotechnology Co., USA). Orthodontic bands with Roth prescription were cemented on the first and second permanent

maxillary and mandibular molar teeth using glass ionomer cement. Trans-palatal and lingual bars were constructed to get good anchorage during anterior teeth retraction.

Firstly, maxillary and first mandibular permanent premolars were extracted, leveling and alignment phase was completed by using NiTi sequence archwires with cinch back posteriorly. Then, canines were retracted on 0.018" stainless steel archwires, with stopper in front of the 1<sup>st</sup> molars and cinch back posteriorly, using elastomeric chain with 150 gm. Finally the anterior teeth were retracted with closing loop on 0.017 × 0.022" stainless steel archwires. Finishing was done with 0.019 × 0.025" NiTi, stainless steel archwires and settling of occlusion was completed then the orthodontic appliances were removed in about two years of treatment.

Second profile photographs were taken after the orthodontic treatment and the effect of treatment was compared.

### Photographic Analysis

Every profile facial photograph was analyzed by AutoCAD program 2008 to calculate the angular measurements. Once the picture was imported to the AutoCAD program, the points and lines would appear that determine the obtained measurement.

### Photographic Points, Lines and Angular Measurements<sup>(11)</sup>

#### Points

1. Point Na' (Nasion soft tissue): The point of deepest concavity of the soft tissue contour of the root of the nose.
2. Point NT (Nasal tip): The most protruded point of the apex nasi.
3. Point Cm (Columella): The most anterior point on the columella of the nose.
4. Point Sn (Subnasale): The point where the lower border of the nose meets the outer contour of the upper lip.
5. Point Ls (Labrale superius): The median point in the upper margin of the upper membranous lip.
6. Point Li (Labrale inferius): The median point in the lower margin of the lower membranous lip.
7. Point B' (soft tissue B): The point of greatest concavity in the midline of the lower lip between labrale inferius and menton.
8. Point Pog' (soft tissue pogonion): The most prominent point on the soft tissue contour of the chin.
9. Point CT (Chin tangent): The most antero-superior point on the soft tissue chin where the

concavity of the soft tissue changes to convexity.

10. Point or (Soft tissue orbitale): The lowest point on the lower margin of each orbit. It is identified by palpation and is identical to the bony orbitale.
11. Point po (Soft tissue porion): The highest point of the upper margin of the cutaneous auditory meatus.

#### Lines

1. Frankfort horizontal plane: It extends between soft tissue porion and orbitale.
2. Na'-Pog' line: It extends between soft tissue nasion and pogonion.
3. Na'- NT line: It extends between soft tissue nasion and the tip of the nose.
4. Sn-Cm line: It extends between subnasale and columella.
5. Sn-Ls line: It extends between subnasale and labrale superius.
6. Na'-Ls line: It extends between soft tissue nasion and labrale superius.
7. Na'-Li line: It extends between soft tissue nasion and labrale inferius.
8. Li-B' line: It extends between labrale inferius and soft tissue B.
9. CT-B' line: It extends between chin tangent and soft tissue B.
10. Na'-Sn line: It extends between soft tissue nasion and subnasale.
11. Sn-Pog' line: It extends between soft tissue subnasale and pogonion.
12. Pog'- NT line: It extends between soft tissue pogonion and the tip of the nose.

#### Angular Measurements

1. Na'-Ls/FH: The inferior, inner facial angle formed by the intersection of a line drawn from nasion (Na') to labrale superius (Ls) and Frankfort plane (FH).
2. Na'-Li/FH: The inferior, inner facial angle formed by the intersection of a line drawn from nasion (Na') to Labrale inferius (Li) and Frankfort plane (FH).
3. Naso-labial angle: The angle formed between columella- Sn line and Sn -Ls line.
4. Na'-Pog'/FH (facial divergence): The inferior, inner facial angle formed by the intersection of a line drawn from nasion (Na') soft tissue pogonion (Pog') and Frankfort plane (FH).
5. Na'-Sn-Pog' (profile angle): The inner angle between Na'-Sn and Sn-Pog' lines.
6. Na'- NT- Pog': The inner angle between Na'- NT and NT- Pog'.
7. Labio - mental angle (Li-B'-CT): The intersection angle at point (B') of the lines

extending from the laberale inferius (Li) and the tangent to the chin.

Non-significant NS P > 0.05  
 Significant S 0.05 ≥ P > 0.01  
 Highly significant HS P ≤ 0.01

**Statistical Analyses**

All the data of the sample were subjected to computerized statistical analysis using SPSS version 20 computer program. The statistical analysis included:

- 1. Descriptive Statistics:** Means and standard deviations.
- 2. Inferential Statistics:** Paired-samples t-test to test the treatment effect.

In the statistical evaluation, the following levels of significance are used:

**RESULTS**

Table 1 showed the descriptive statistics and treatment effect of the bimaxillary protrusion of extraction of four premolars.

The results showed highly significant decrease in the upper and lower lips protrusion and increase in the naso-labial and mento-labial angles.

The facial divergence and profile angle showed non-significant difference.

**Table 1. Descriptive Statistics and Treatment Effect on the Angular Measurements.**

Angular measurements (degree)	Descriptive statistics				Difference (d.f. = 9)		
	Before treatment		After treatment		Mean difference	t-test	p-value
	Mean	S.D.	Mean	S.D.			
Na'-Ls/FH	102.6	3.89	89.7	4.11	12.9	129	0.000 (HS)
Na'-Li/FH	99.6	3.89	94.7	3.83	4.9	49	0.000 (HS)
Naso-labial angle	76.1	3.35	93.2	3.49	-17.1	-171	0.000 (HS)
Na'-Pog'/FH	89.6	3.06	88.9	3.13	0.7	19	0.142 (NS)
Na'-Sn-Pog'	167.9	3.28	168.8	3.22	-0.9	-9	0.257 (NS)
Na'- NT- Pog'	130.85	3.02	131.325	3.32	-0.475	-0.513	0.621 (NS)
Labio - mental angle	124.95	2.95	141.85	2.81	-16.9	-169	0.000 (HS)

**DISCUSSION**

When a decrease of lip procumbency is wanted, extracting premolars and retracting incisors is a practicable option to complete these objectives. On the basis of the patient's chief complaint and the diagnosis of the malocclusion, extracting the maxillary and mandibular first premolars was indicated<sup>(12)</sup>.

When extracting premolars is preferred to correct the malocclusion, the treatment plan must address space closure of the extraction sites. Closure of the extraction sites can happen by retraction of the anterior segments, protraction of the posterior segments, or a combination of the two<sup>(13)</sup>. Maximum anchorage indicates to prevent mesial movement of the posterior segments in the anteroposterior dimension. Maximum anchorage in this case was necessary and predicated on the need to restrict mesial movement of the maxillary and mandibular first molars until the crowding and bimaxillary protrusion were resolved.

To increase anchorage, adjunctive appliances, such as a trans-palatal bar, a Nance holding arch, palatal implants, or extra-oral traction, are usually necessary. Intraoral sources of anchorage include alveolar bone, teeth, dental arches, palatal and

mandibular basal bone and differential moment mechanics<sup>(13)</sup>.

Renfro<sup>(14)</sup> stated that, to be stable, the anchorage unit must be overwhelmingly more resistant than with the moving teeth. In this case, anchorage in the maxilla was achieved with a trans-palatal bar, bonding of the second molar, and Class II elastics. Mandibular anchorage was achieved by bonding the second molars. Nowadays, mini-implants provide excellent anchorage control and considered to be effective that the trans-palatal bar. In this study, trans-palatal and lingual bar were used on the maxillary and mandibular first and second molars to increase the anchorage.

Generally the prominence of the upper and lower lips was reduced significantly about 12.9 degrees for the upper lip and about 4.9 for the lower lip; this is due to the retraction of the maxillary and mandibular incisors<sup>(15,16)</sup>.

Figure 1 confirms that the naso-labial and labio-mental angles were increased significantly due to the retraction of the maxillary and mandibular anterior teeth; this comes in agreement with Bravo<sup>(15)</sup>. Sukhia *et al.*<sup>(16)</sup> who found significant increase for the naso-labial angle and non-significant for labio-mental angle.

Lo and Hunter<sup>(17)</sup> reported that the greater the maxillary incisor retraction the greater the increase in the naso-labial angle. In the present study, the naso-labial angle was increased about 17 degrees.

The soft tissue nasion and the tip of the nose to the soft tissue pogonion revealed non-significant difference after treatment. This indicates that the retraction of the anterior teeth may not affect the underlying basal bone and hence the soft tissue pogonion followed the bony one, so the soft tissue profile is not affected. The small change in Na'-Sn-Pog' angle (0.9 degrees) was attributed to the backward position of the subnasale after treatment.

As a conclusion; treatment of bimaxillary protrusion with fixed orthodontic appliances and extraction of four premolars improves the facial esthetics of the patients by decreasing the lip projection and increasing the naso-labial and mento-labial angles.

Careful evaluation of patients with bimaxillary protrusion is needed to gain more information on the possible consequences of incisor retraction, so one should bear in mind that individual variation in response is great. Therefore, it would be prudent to inform the patient of average changes to expect, while also informing the patient that in his/her particular instance, this could be different.



**Before treatment**



**After treatment**

**Figure 1: Case Pre and Post Treatment.**

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