INTRODUCTION

Bimaxillary Protrusion or full mouth appearance is an unesthetic condition resulting from protrusive and proclined upper and lower incisors with resultant procumbency of lips, convexity of face and excessive vermilion show of upper and lower lips. It is seen commonly in African-American and Asian populations, but it can be seen in almost every ethnic group. Bimaxillary dental protrusion is predominant among black people but is also found among whites.

Like facial divergence; lip prominence is strongly influenced by racial and ethnic characteristics. Whites of northern European backgrounds often have thin lips, with minimal lip and incisor prominence. Whites of southern European and middle eastern origin normally have more lip and incisor prominence than their northern cousins. Greater degree of lip and incisor prominence normally occur in Orientals and in blacks.

This difference simply means that a degree of lip and incisor prominence normal for many whites would be considered retrusive for many Orientals or blacks. While a lip and tooth position normal for blacks would be excessively protrusive for most whites.

Bimaxillary dentoalveolar protrusion is seen in the facial appearance in three ways. Excessive separation of lips at rest (lip incompetence), Excessive efforts to bring the lips into closure (lips strain), Prominence of lips in profile view all three characteristics must be present to make the diagnosis of dental protrusion and the lip protrusion. The etiology of bimaxillary protrusion is multifactorial and consists of a genetic component as well as enviromental factors such as mouth breathing, lip habits and skeletal factors.

Saudi adults living in the Western region of Saudi Arabia, also known as Hijaz presenting with ethnic diversity were found to have an increased facial con-
vexity, a more convex profile and a steeper mandibular plane. In addition, the upper and lower incisors were significantly proclined and more protruded. In another study smaller interincisal angle, smaller nasolabial and upper and lower lip protrusion, smaller anterior and total cranial base and cranial base angle, larger lower and total of the anterior and posterior facial heights were found.

Similarly in African patients with procumbent upper and lower lips, a deep mentolabial sulcus, excessive vermilion show of the upper and lower lips, excessive lip strain on closure, a convex profile, a long lower facial height and proclined and protruded maxillary and mandibular incisors are reported to be present.

In Orthodontic practice cephalometric radiography is most commonly used to evaluate and analyze soft tissue pattern. The term cephalometry means the scientific measurement of the dimensions of craniofacial complex. Cephalometry allows a direct measurement of the dimensions of the head and face based on skeletal, dental and soft tissue landmarks. A number of cephalometric analyses have been designed and modified from time and on namely Tweed, Steiners, Ricketts, Burstone, Holdaway and Witts analyses. Cephalometrics provides data for both population based cross sectional study as well as longitudinal study relating to the same individual. A large variability in lip position can be expected on lateral cephalograms even when patients are instructed to keep their lips relaxed and their teeth in occlusion because of the flexible and mobile lip texture.

The lip extension can easily adapt to incisor displacements and become wider or narrower, due to extensive mobility.

In the study of racial variations in cephalometric analysis between Whites and Kuwaitis it is reported that the Kuwaitis show more protrusive upper and lower lips and more facial convexity. All the measurements relating the upper and lower incisors to the maxilla and the mandible, respectively showed a significant bimaxillary protrusion.

Keating used cephalometrics to determine the morphological features of bimaxillary protrusion in a strictly Caucasian population. It was observed that bimaxillary protrusion is associated with a shorter posterior cranial base, a longer and more prognathic maxilla, a mild class II skeletal pattern, a smaller upper and posterior facial heights, diverging facial planes and a procumbent soft tissue profile with a low lip line.

Lip structure seems to have an influence on lip response to incisor retraction.

To determine the effects of incisor retraction on the profile, several studies have been conducted to quantify and predict the relationship between incisor retraction and lip retraction.

Wisth found that lip response, as a proportion of incisor retraction, decreased as the amount of incisor retraction increased. This seems to indicate that the lips have some inherent support.

Riveiro, Quintanilla, Chamosa and Cunqueiro conducted a study on soft tissue profile of a Europeans white population of young adults by means of linear measurements in natural head position such as upper/lower lip length, upper/lower vermilion etc. According to their study no significant difference was found among the values of upper and lower lip vermilion.

Canut in 1996 introduced esthetic analysis; He studied the interrelationship of nasal, labial, and chin prominences with regard to the Sn-Sm line (facial esthetic trail) and the depth of the nasolabial sulcus that he called the nasolabial esthetic sigma and measured between 2 perpendicular lines to the frankfort plane through Sn and Ls.

This article reports on a comparative cross sectional study that was conducted on the subjects presenting with bimaxillary protrusion. The aim of this study was to compare the lip morphology in bimaxillary protrusion on skeletal class I and class II pattern.

METHODOLOGY

This cross sectional comparative study was conducted in the Orthodontic Department of Dental Section of Children Hospital and Institute of Child health, Lahore. The sample consisted of 100 subjects of age range 18-25 years. Out of this sample size, 50 were having class I skeletal pattern and other 50 had class II skeletal pattern.
Inclusion criteria
Age range 18-25 years.
Permanent dentition.
Patients with class I and class II skeletal pattern.

Exclusion criteria
Supernumerary teeth.
Parafuional habits like mouth breathing, thumb sucking.
Patients with class III skeletal pattern.

DATA COLLECTION PROCEDURE
The sample was collected from the Allied Health Sciences, the Nursing School The Childrens' Hospital and The Institute of Child Health, Lahore. Lateral cephalometric radiographs of the subjects were attained from the Orthosphos plus machine. The each subject was standing in natural head position with relaxed lips and teeth in centric occlusion. The head was positioned in the cephalostat with ear rods. The x-ray source was placed on the right side of the patient at a distance of 5 feet from the midsagittal plane. The subject film distance was 1 foot. Exposure was made for 1.2 seconds for each radiograph. Tracing sheets were fixed along the whole length of the left side border of the cephalograms with adhesive tape. The lateral Cephalogram of each subject was traced and measured manually by the same operator on 0.003 inch thick and 8 by 10 inch size acetate paper with 3H lead pencil.

Following lateral landmarks were identified on the lateral radiographs.

1 Sella (S): the mid point of the pituitary fossa of the sphenoid bone.
2 Nasion (N): the point in the midline located at the nasal root.
3 Porion (Po): the superior most point on the external auditory meatus.
4 Orbitale (Or): the lower most point on the inferior margin of the orbit.

5 Point A: is the deepest point on the concavity formed by the anterior maxillary contour of the alveolar process.
6 Point B: is the deepest point on the concavity of the anterior surface of the symphysis.
7 Menton: The most inferior point on the inferior border of the chin.
8 Subnasale (Sn): The point where the upper lip joins the columella.
9 Steiner’s point (St): The point at ¼ of the distance between Pn & Sn.
10 Pronasale (Pn): The most prominent point on the tip of the nose.
11 Labial superioris (Ls): The point that indicates the mucocutaneous limit of the upper lip.
12 Stomion superior (Sts): The most inferior point of the upper lip.
13 Stomion inferior (Sti): The most superior point of the lower lip.
14 Labial inferioris (Li): The point that indicates the mucocutaneous limit of the lower lip.
15 Supramentale (Sm): The deepest point of the inferior sublabial concavity.
16 Pogonion (Pog): the most anterior point of the soft tissue chin.

The cephalometric analysis of each of the study sample was prepared at two different occasions. For the purpose of diagnosis, 20 variables were selected both angular and linear from the following different methods, making use of multiple reference lines, in order to prepare a comprehensive cephalometric analysis.

Angular measurement used from Steiner’s analysis included sella nasion- point A SNA 80±2degrees, sella nasion- point B SNB is 78±2 degrees, Point A-nasion- point B ANB 0±2 degrees, Upper incisor to SN plane 102±2 degrees, Sella nasion to mandibular plane, norm used for SN-MP 32±4 degrees. Steiner’s (S) Line (0±2mm).
The E plane from Ricketts analysis intersects the most prominent points on the tip of the nose and the chin. It is used to assess soft tissue balance between the lips and the profile. The mean distance of the lower lip from the E plane is approximately -2±2 mm and of upper lip is -3±2 mm.

The angular measurements taken from Tweed triangle were incisor mandibular plane angle IMPA (90°± 5°), Frankfort mandibular plane angle FMA (25°±5°) and Frankfort mandibular incisor angle FMIA 65°±5°.

Witt’s Method used in this study included perpendiculars from point A and point B to the functional occlusal plane(used as reference plane) and the linear difference between these points was measured. In a well proportioned face BO is 1mm ahead of point A in the male where as both these projections fall on the same point in the female.

Measurements taken from Holdaway analysis were; the upper lip thickness mean value is 15 ±2mm. upper lip strain 15mm.

Burstone carried out an exhaustive esthetic analysis of the facial profile. Within the linear parameters, he defined the position of the upper (Ls) and lower (Li) lips regarding the Sn-Pg line, the nasal length (measured perpendicular to the palatal plane), the length of the upper lip from subnasale to stomion superior (SnsSto) and lower lip from stomion inferior to menton (Sto-Me), and the interlabial gap (Sto-Stois), Upper lip length: Sns-Ss, mean is 18±1.5mm, lower lip length: SisSm, mean is 23±1.5mm, , lower lip thickness: mean is 19±2mm, upper lip vermilion:Ls-Ss, mean is 8.5±1.5mm, lower lip vermilion:Si-Li, mean is 10.2±1.6mm.

DATA ANALYSIS PROCEDURE

The study included five angular and one linear measurements for skeletal analysis namely SNA, SNB, ANB, Witts value, SNM, FMA, three angular measurements for dental analysis namely UI-SN, IMPA, FMIA and eleven linear measurements for soft tissue analysis namely Lower lip to E line, Upper lip to E line, Upper lip to S line, Lower lip to S line, Upper lip length / thickness, Upper lip strain, Lower lip length / thickness, Upper lip vermilion, and Lower lip vermilion. The results were analysed by using the SPSS 10.0.

Descriptive analysis was used for finding the norms, mean and standard deviations.

The mean and norms were then subjected to independent t test for significant differences between the mean values.

RESULTS

The study sample consisted of 100 (hundred) subjects which were divided into two groups.

Group 1 consisted of 50 (fifty) subjects having bimaxillary protrusion with class I skeletal pattern. Group 2 consisted 50 (fifty) subjects having bimaxillary dentoalveolar protrusion with class II skeletal pattern.

For the same age range the angular measurements of skeletal analysis, dental analysis and linear measurements of soft tissue analysis of class I skeletal pattern were compared with the angular measurements of skeletal analysis, dental analysis and linear measurements of soft tissue analysis of class II skeletal pattern and the difference was analysed using t- test. P-value less than 0.05 were considered level of significance, P< 0.01 a highly significant and P< 0.001 as statistically very highly significant.

For subjects with class I skeletal pattern, the mean SNA was 82.870(SD 3.612), mean SNB was 79.670(SD 3.582), mean ANB was 3.200(SD 1.049), mean AO-BO distance was 2.600(SD 1.956), mean SNM was 31.640(SD 6.170), mean FMA was 25.660(SD 7.000) shown in Table 1.

For dental analysis, the mean UI to SN was 115.120(SD 5.501), mean IMPA was 102.700(SD 3.400), mean FMIA was 55.500 (SD 5.493) shown in Table 2.

Similarly linear measurements for soft tissue analysis of subjects with class I skeletal pattern, the mean lower lip to E line was 0.9300(SD 0.067), mean upper lip to E line was 1.6200(SD 2.594), mean Upper lip to S line was 1.3500(SD 2.343), mean Lower lip to S line was 2.6000(SD 2.969), mean upper lip length was 21.2600(SD 2.238), mean upper lip thickness was 15.3200(SD 2.084), mean upper lip strain was 11.1200(SD 2.228), mean lower lip length was 16.1800(SD 2.876), mean lower lip thickness was 12.3800(SD 1.523), mean upper lip vermilion was 10.5200(SD 1.693), and mean lower lip vermilion was 11.7800(SD 1.798) as shown in Table 3.
### TABLE 1: A COMPARATIVE SKELETAL ANALYSIS OF SUBJECTS WITH CLASS I AND CLASS II SKELETAL PATTERN

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Mean values</th>
<th>SD</th>
<th>t-value</th>
<th>P-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean SNA (class I skeletal pattern) (degrees)</td>
<td>82.8700</td>
<td>3.61235</td>
<td>-2.538</td>
<td>0.013</td>
<td>Significant</td>
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<tr>
<td>Mean SNA (in class II skeletal pattern) (degrees)</td>
<td>84.7000</td>
<td>3.59847</td>
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<tr>
<td>Mean SNB (class I skeletal pattern) (degrees)</td>
<td>79.6700</td>
<td>3.58228</td>
<td>3.841</td>
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<tr>
<td>Mean SNB (class II skeletal pattern) (degrees)</td>
<td>77.1400</td>
<td>2.97616</td>
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<tr>
<td>Mean ANB (class I skeletal pattern) (degrees)</td>
<td>3.2000</td>
<td>1.04978</td>
<td>-13.494</td>
<td>0.000</td>
<td>Very Highly Significant</td>
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<tr>
<td>Mean ANB (class II skeletal pattern) (degrees)</td>
<td>7.4800</td>
<td>1.98196</td>
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<tr>
<td>Mean Witt's value (class I skeletal pattern) (mm)</td>
<td>2.6000</td>
<td>1.95615</td>
<td>-6.908</td>
<td>0.000</td>
<td>Very Highly Significant</td>
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<tr>
<td>Mean Witt's value (class II skeletal pattern) (mm)</td>
<td>6.2300</td>
<td>3.15939</td>
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<tr>
<td>Mean SNM (class I skeletal pattern) (degrees)</td>
<td>31.6400</td>
<td>6.17024</td>
<td>-3.050</td>
<td>0.003</td>
<td>Highly Significant</td>
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<tr>
<td>Mean SNM (class II skeletal pattern) (degrees)</td>
<td>35.0200</td>
<td>4.82971</td>
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<tr>
<td>Mean FMA (class I skeletal pattern) (degrees)</td>
<td>25.6600</td>
<td>7.00032</td>
<td>-2.312</td>
<td>0.023</td>
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<tr>
<td>Mean FMA (class II skeletal pattern) (degrees)</td>
<td>28.5800</td>
<td>5.54790</td>
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</table>

### TABLE 2: A COMPARATIVE DENTAL ANALYSIS OF SUBJECTS WITH CLASS I AND CLASS II SKELETAL PATTERN (DEGREES)

<table>
<thead>
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<th>Variable name</th>
<th>Mean values</th>
<th>SD</th>
<th>t-value</th>
<th>P-value</th>
<th>Significance</th>
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<tr>
<td>Mean UI to SN (class I skeletal pattern) (degrees)</td>
<td>115.1200</td>
<td>5.50191</td>
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<td>0.720</td>
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<td>Mean UI to SN (class II skeletal pattern) (degrees)</td>
<td>114.7347</td>
<td>5.15904</td>
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<tr>
<td>Mean IMPA (class I skeletal pattern) (degrees)</td>
<td>102.7000</td>
<td>3.40018</td>
<td>-1.091</td>
<td>0.278</td>
<td>Not Significant</td>
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<td>Mean IMPA (class II skeletal pattern) (degrees)</td>
<td>103.4694</td>
<td>3.61768</td>
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<td>Mean FMIA (class I skeletal pattern) (degrees)</td>
<td>55.5000</td>
<td>5.49304</td>
<td>3.011</td>
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<td>Highly Significant</td>
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<td>Mean FMIA (class II skeletal pattern) (degrees)</td>
<td>51.8163</td>
<td>6.63850</td>
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</tr>
<tr>
<td>Variables name</td>
<td>Mean values</td>
<td>SD</td>
<td>t-Value</td>
<td>P-Value</td>
<td>Significance</td>
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<td>Mean L..lip to E line(class I skeletal pattern)</td>
<td>0.9300</td>
<td>3.06729</td>
<td>-3.948</td>
<td>0.000</td>
<td>Very Highly Significant</td>
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<td>Mean L..lip to E line(class II skeletal pattern)</td>
<td>3.6100</td>
<td>3.69264</td>
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<td>Mean U..lip to E line(class I skeletal pattern)</td>
<td>-1.6200</td>
<td>2.59426</td>
<td>-4.677</td>
<td>0.000</td>
<td>Very Highly Significant</td>
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<td>Mean U..lip to E (class II skeletal pattern)</td>
<td>0.9700</td>
<td>2.93364</td>
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<td>Mean U..lip to S line(class I skeletal pattern)</td>
<td>1.3500</td>
<td>2.34358</td>
<td>-4.081</td>
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<td>Very Highly Significant</td>
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<td>Mean U..lip to S line(class II skeletal pattern)</td>
<td>3.6500</td>
<td>3.22340</td>
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<td>Mean L..lip to S line(class I skeletal pattern)</td>
<td>2.6000</td>
<td>2.96923</td>
<td>-3.425</td>
<td>0.001</td>
<td>Highly Significant</td>
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<td>Mean L..lip to S line(class II skeletal pattern)</td>
<td>4.8600</td>
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<td>Mean U..lip length (class I skeletal pattern)</td>
<td>21.2600</td>
<td>2.23890</td>
<td>-0.274</td>
<td>0.784</td>
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<td>Mean U..lip length(class II skeletal pattern)</td>
<td>21.4200</td>
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<td>Mean U..lip thickness(class I skeletal pattern)</td>
<td>15.3200</td>
<td>2.08434</td>
<td>1.642</td>
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<td>Mean U..lip thickness(class II skeletal pattern)</td>
<td>14.5000</td>
<td>2.85178</td>
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<tr>
<td>Mean U..lip strain (class I skeletal pattern)</td>
<td>11.1200</td>
<td>2.22821</td>
<td>0.567</td>
<td>0.572</td>
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<td>Mean U..lip strain(class II skeletal pattern)</td>
<td>10.7200</td>
<td>4.45861</td>
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<td>Mean L..lip length(class I skeletal pattern)</td>
<td>16.1800</td>
<td>2.87629</td>
<td>1.112</td>
<td>0.269</td>
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<td>Mean L..lip length(class II skeletal pattern)</td>
<td>15.5600</td>
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<td>Mean L..lip thickness(class I skeletal pattern)</td>
<td>12.3800</td>
<td>1.52382</td>
<td>-1.114</td>
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<td>Not Significant</td>
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<td>Mean L..lip thickness(class II skeletal pattern)</td>
<td>12.7600</td>
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<td>Mean U..lip Verm(class I skeletal pattern)</td>
<td>10.5200</td>
<td>1.69320</td>
<td>-1.653</td>
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<td>Not Significant</td>
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<td>Mean U..lip Verm(class II skeletal pattern)</td>
<td>11.1100</td>
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<td>Mean L..lipVerm(class I skeletal pattern)</td>
<td>11.7800</td>
<td>1.79898</td>
<td>-0.497</td>
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<td>Mean L..lipVerm(class II skeletal pattern)</td>
<td>11.9500</td>
<td>1.61703</td>
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</table>
For subjects with class II skeletal pattern, the mean SNA was 84.700 (SD 3.598), mean SNB was 77.140 (SD 2.976), mean ANB was 7.480 (SD 1.981), mean AO-BO distance was 6.230 (SD 3.829), mean SNM was 35.020 (SD 4.829), mean FMA was 28.580 (SD 5.547) shown in Table 1.

Angular measurements for dental analysis of subjects with class II skeletal pattern were as follows, the mean UI to SN was 114.7347 (SD 5.159), mean IMPA was 103.4694 (SD 3.617), mean FMIA was 51.8163 (SD 6.638) shown in Table 2.

Similarly linear measurements for soft tissue analysis of subjects with class II skeletal pattern, the mean lower lip to E line was 3.610 (SD 3.692), mean upper lip to E line was 0.9700 (SD 2.933), mean upper lip thickness was 14.500 (SD 2.851), mean upper lip to E line was 3.650 (SD 3.223), mean lower lip to S line was 4.860 (SD 3.599), mean upper lip length was 21.420 (SD 3.464), mean upper lip thickness was 12.760 (SD 2.696), mean upper lip strain was 10.720 (SD 4.458), mean lower lip to S line was 4.860 (SD 3.599), mean upper lip length was 21.420 (SD 3.464), mean upper lip thickness was 14.500 (SD 2.851).

DISCUSSION

The material for this study consisted of 100 lateral cephalograms. There were 50 subjects with skeletal class I pattern and 50 subjects with skeletal class II pattern in the study sample. The mean age of the whole sample was 18-25 years.

The purpose of this study was to compare the effects of lip morphology in the development of bimaxillary protrusion on skeletal class I and class II pattern. The study was based on cephalometric radiography. The purpose of cephalometry is to interpret geometric expression of cranial anatomy.

Among four variables of the skeletal sagittal analysis three elements were found statistically very highly significant with (P<0.001). The findings of Bills and Farrow match the result of our study. Statistically significant difference was found in the value of (SNA) sella nasion maxillary apical base angle (P-value 0.013) amongst the class I and class II skeletal pattern. These findings were unlike the description of Cowson, Bloom and Mingchu. Statistically, very highly significant difference (P-value 0.000) however was found among the values of sella nasion mandibular apical base angle (SNB), maxillary apical base nasion mandibular apical base angle (ANB) and Witts value (AO-BO distance) like the findings of other researcher such as Hassan, Fujita and Riveiro.

Among the vertical analysis, statistically significant difference was found in the values of frankfort mandibular plane angle (FMA) (P-value 0.023) and highly significant difference in sella nasion mandibular plane angle (SNM) (P-value 0.003) These results supports the findings of Proffit and Ming. Among the vertical analysis, statistically significant difference was found in the values of fankfort mandibular plane angle (FMA) (P-value 0.023) and highly significant difference in sella nasion mandibular plane angle (SNM) (P-value 0.003) These results supports the findings of Proffit and Ming. Among the vertical analysis, statistically significant difference was found in the values of fankfort mandibular plane angle (FMA) (P-value 0.023) and highly significant difference in sella nasion mandibular plane angle (SNM) (P-value 0.003) These results supports the findings of Proffit and Ming. Among the vertical analysis, statistically significant difference was found in the values of fankfort mandibular plane angle (FMA) (P-value 0.023) and highly significant difference in sella nasion mandibular plane angle (SNM) (P-value 0.003) These results supports the findings of Proffit and Ming. Among the vertical analysis, statistically significant difference was found in the values of fankfort mandibular plane angle (FMA) (P-value 0.023) and highly significant difference in sella nasion mandibular plane angle (SNM) (P-value 0.003) These results supports the findings of Proffit and Ming. Among the vertical analysis, statistically significant difference was found in the values of fankfort mandibular plane angle (FMA) (P-value 0.023) and highly significant difference in sella nasion mandibular plane angle (SNM) (P-value 0.003) These results supports the findings of Proffit and Ming.
seven variables namely upper lip length (P-value 0.784), upper lip thickness (P-value 0.104), upper lip strain (P-value 0.572), lower lip length (P-value 0.269), lower lip thickness (P-value 0.268), upper lip vermillion (P-value 0.102), and lower lip vermillion (P-value 0.620).

These findings concides with those of Burstone13, Riveiro25, Wisth24 and Ming29 Statistically, very highly significant difference (P-value 0.000) was found among the values of lower lip to Esthetic line, upper lip to E line, upper lip to Steiner's line, lower lip to S line (P-value 0.001) similar to the findings of Keating19. The mean values of upper lip to E line, upper lip to S line, and lower lip to S line were slightly higher in class II skeletal pattern, but the difference did not achieve statistical significance.

These findings in all the three analysis contradict the hypothesis that there is a difference in the lip morphology in subjects having bimaxillary protrusion on class I and class II skeletal pattern.

CONCLUSIONS

On the basis of the results attained, it can be concluded that no significant difference was found in the lip morphology in subjects having bimaxillary dentoalveolar protrusion on class I and class II skeletal pattern.

REFERENCES