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# Comparative Evaluation of Dentoskeletal Factors, Soft Tissue Structures, Facial Length and Projections to TVL (True Vertical Line) as an Aid in Diagnosis and Treatment Planning

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## ABSTRACT

**Background**: It is only recently that a soft tissue paradigm shift has occurred in orthodontics focussing on the treatment of dentofacial problems based on soft tissues. So during the diagnosis and treatment planning of dentofacial deformities both hard and soft tissues factors should be taken into consideration. **Aims and objectives**: The aim of this study was to evaluate and compare the various dentoskeletal factors, soft tissue structures, facial length and measurements with respect to the true vertical line in various skeletal malocclusion groups and their influence on diagnosis and treatment planning. **Methods**: A total sample of 60 subjects with 20 subjects in each Class I skeletal pattern, Class II skeletal pattern and Class III skeletal pattern were included. The level of significance was set at 0.05. A total of 60 subjects (ages 18–30 years) were included, with male and female subjects. The dentoskeletal, soft tissue cephalometric analysis and measurements with respect to the true vertical, facial length measurements were done and compared with each other in different skeletal malocclusion groups and mean values, SDs, values were calculated with Statistical software SPSS (version 20.0) and Microsoft Excel. **Results**: Descriptive statistical analysis was carried out in all the three different groups for each parameter with 95% confidence limits and then means, SDs for each variable was calculated from the average mean value. In class I, class II, class III groups the maxillary occlusal plane angle showed values of 81.75±5.0, 82.85±4.6, 81.45±3.6 respectively which was statistically significant. In class III group and class II group the mandibular incisor to mandibular occlusal plane angulation was 76.25±8.5 and 58.96±4.32 respectively which was statistically significant. In class I group no statistically significant differences were found in other parameters except lower 1/3rd of face with a value of 104.5±5.6mm which was statistically significant. In class II and class III group the overjet value was 7.45±2.1mm and -0.85±2.8mm respectively which was statistically significant with decreased facial length and both hard and soft-tissue projections to true vertical were varying and the statistically significant differences were found in class II subjects but not in class III subjects in our sample. **Conclusion**: In class I subjects all the parameters were within the normal range so they can be corrected non surgically but in cases of class II and class III subjects there are varying difference in certain parameters, in our study there were many significant differences but they were within the limits of orthodontic treatment which can be camouflaged with dental compensation, but if compensations are already there and discrepancy is severe, a surgical option should be considered.

***Keywords:*** Hard tissue paradigm, soft tissue paradigm, malocclusion.

## INTRODUCTION

Since the specialty was established 100 years ago, orthodontic theory and practice have been based on Angle's paradigm.[1] It is predicted that on a teleological belief system that assumes that when a "natural'' dentitional state of ideal alignment and occlusion occurs, the face should also be in perfect harmony and stomatognathic system should function ideally. The goal of this treatment was to produce perfect occlusion of the teeth, and the facial beauty naturally would follow as "natures intended ideal form" was achieved. That idea was discredited many year ago, and early in the cephalometric era it was documented that hard tissue characteristics did not reliably determine facial features.[2] However the basic concept that the dentition and facial skeleton determined the goals of treatment remained intact until recently. There has been a paradigm shift called the soft tissue paradigm which states that both the goals and limitations of modern orthodontic and orthognathic treatment are determined by soft tissues of the face, not by the hard tissues and bones. Nonetheless, once a paradigm shift has occurred, a veritable explosion of new ideas and information leads to rapid advances in the field.[3] Thus an important goal of diagnosis and treatment planning for dentofacial deformities is to ascertain an

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individual's available limits of soft tissue adaptation and the most desirable hard tissue–soft tissue relationships.[4] Given the primacy of soft tissues, clinicians must establish treatment plans for the dentition and facial skeleton by reverse engineering deducing what would have to be done to the hard tissues in order to achieve the desired soft tissue outcomes. So the purpose of this study was to evaluate the various dentoskeletal factors, soft tissue structures, facial length and measurements with respect to the true vertical in various skeletal malocclusion groups and their influence on diagnosis and treatment planning.

**Aims and Objectives**

The main purpose of this study was to evaluate and compare the various dentoskeletal factors, soft tissue structures, facial length and measurements with respect to the true vertical line in various skeletal malocclusion groups and their influence on diagnosis and treatment planning and how to develop a unified treatment plan by taking into consideration the concepts of both hard tissue soft tissue relationships.

## MATERIALS AND METHODS

A total sample of 60 (aged 18–30 years) male and female subjects with 20 subjects in each Class I skeletal pattern, Class II skeletal pattern and Class III skeletal pattern were included who had to undergo orthodontic treatment at the Department of Orthodontics Government Dental College and Hospital Srinagar, Kashmir. The subjects were selected based on certain parameters like ANB angle,[12] and Beta angle and Witt's appraisal.[13,14] A lateral headfilm was obtained with the model positioned in natural head position with normally seated condyle, and with passive lips.[5] Natural head position was obtained by asking the subject to look straight ahead such that the visual axis was parallel to the floor. Lundstrom and Lundstrom noted that despite careful natural head position instructions, some patients assume an "unnatural head position." Accordingly, these patients need adjustment to natural "head orientation" by experienced clinicians. As noted by Lundstrom and Lundstrom, our models also assumed head positions that were obviously not a natural head position. These headfilms, as per Lundstrom and Lundstrom, were leveled to natural head orientations.[6] The True Vertical Line (TVL) was then established. The line was placed through subnasale and was perpendicular to the natural horizontal head position.[7] All the lateral cephalometric radiographs were taken by the same operator from the standardized Orthophos XG5 DS CEPH (SIRONA) on a standard Konica Minolta 8 × 10 inch size film with an anode to mid subject distance of 5 feet by the same operator. All the lateral cephalograms were traced upon an A4 size acetate paper with a 2B or 3HB hard lead pencil over well-illuminated viewing screen. Dentoskeletal factors, soft tissue structures, facial length and measurements with respect to the true vertical in various skeletal malocclusion groups were measured as shown below by using different planes and parameters.[8-11] The linear measurements were recorded with a measuring scale up to a precision of 0.5 mm.

**Inclusion Criteria**

- Patients with different types of skeletal malocclusions.
- Patients not more than 30 years of age.
- Complete eruption of the all the permanent teeth.
- The radiographs had to be of high quality and sharpness.
- All the radiographs to be taken by the same operator and in the natural head position.

**Exclusion Criteria**

- Patients with craniofacial anomalies and syndromes.
- Cleft lip and cleft palate patients.
- Cases with congenitally missing teeth.
- X-Ray scans showing supernumerary teeth, enlarged/cystic follicle, or any other pathology.
- History of facial trauma.

**Planes and Parameters Defined**

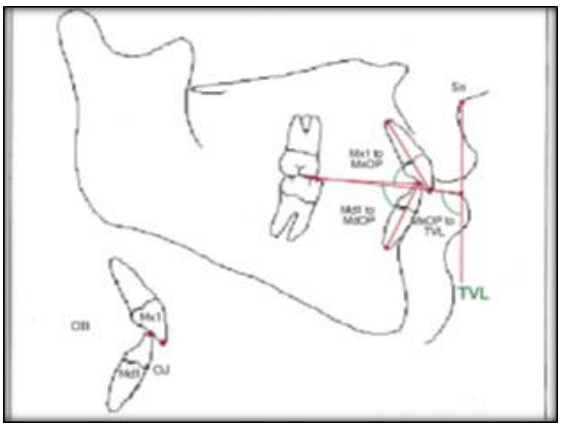


**Figure 1: Dentoskeletal factors: Upper incisor to maxillary occlusal plane, lower incisor to mandibular occlusal plane, maxillary occlusal plane, overbite, and overjet are represented. The dentoskeletal factors to a large extent control esthetic outcome.[8-9]**

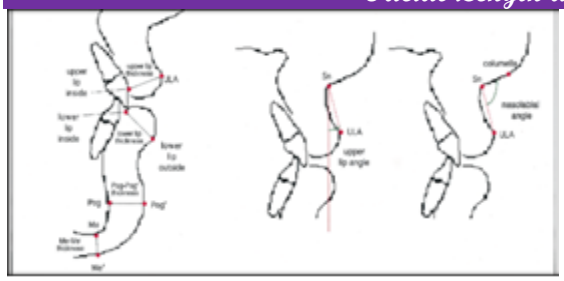

**Figure 2: Soft tissue structures: Tissue thickness at upper lip, lower lip, Pogonion, and Menton, are depicted. Soft tissue thickness and dentoskeletal factors determine the profile. Upper lip angle and nasolabial angle are depicted. These soft tissue structures are altered by movement of the incisor teeth. These angles should be studied before orthodontic overjet correction to assess the potential for changes out of normal range.[10-11]**

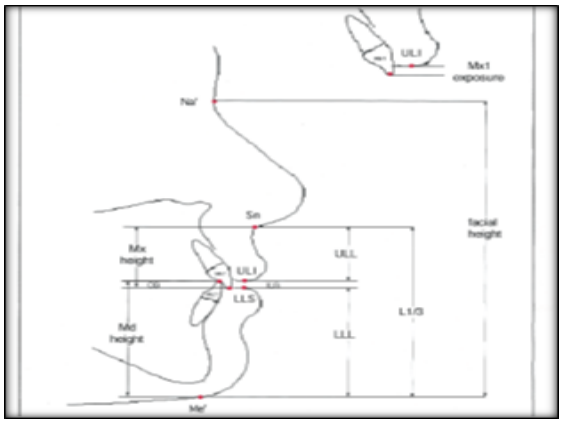

**Figure 3: Facial lengths: Key facial lengths are depicted. Soft tissue lengths include facial height (Na' to Me'), lower one-third height (Sn to Me'), upper lip length (Sn to upper lip inferior), lower lip length (lower lip superior to Me'), and interlabial gap (upper lip inferior to lower lip superior). Soft tissue to hard tissue measurements include maxillary incisor exposure (upper lip inferior to maxillary incisor tip), maxillary height (Sn to maxillary incisor tip), and mandibular height (mandibular incisor tip to Me).**
**The only hard tissue to hard tissue measurements is the overbite.[8,9]**

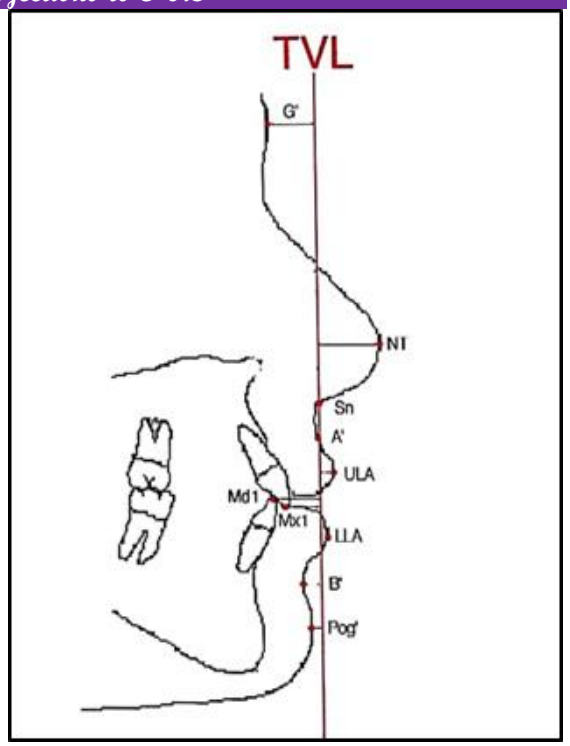


**Figure 4: TVL projections: TVL is placed through subnasale except when maxillary retrusion exists. Maxillary retrusion is based on clinical nasal projection (short, normal, long), clinical orbital rim, cheek bone, subpupil, and alar base contours (depressed, flat, normal, prominent), clinical upper lip support (by incisor, gingiva, no support [air]), cephalometric upper lip angle, and cephalometric upper lip thickness. When midface retrusion is diagnosed the TVL is moved 1 to 3 mm anterior. Midface retrusion is defined by clinical factors (long nose, deficient midface structures, poor incisor upper lip support) and cephalometric factors (upright upper lip and/or thick upper lip). Profile points measured to TVL are Glabella (G'), nasal tip (NT), soft tissue A' point (A'), upper lip anterior (ULA), lower lip anterior (LLA), soft tissue B' point (B'), and soft tissue Pogonion' (Pog'). Hard tissue measured to the TVL are upper incisor tip and lower incisor tip.[8,9]**

## Statistical Analysis

On the basis of the cephalometric soft and hard tissue landmarks, measurements were done on 60 subjects with 20 subjects in each skeletal group for dentoskeletal, soft tissue structures, vertical projection, and facial length were measured. Descriptive statistical analysis was carried out in all the three different groups for each parameter with 95% confidence limits and then means, SDs for each variable was calculated from the average mean value.

**Table 1: Analysis of dentoskeletal factors, soft tissue structures, facial length and projections to TVL (True Vertical line) in skeletal class I group**

| | Mean ± SD Females | Mean ± SD Male | Mean class I group | SD class I group |
|---|---|---|---|---|
| **Dentoskeletal factors** | | | | |
| Mx occlusal plane | 95.6 ± 1.8 | 95.0 ± 1.4 | 81.75 | 5.0 |
| Mx1 to Mx occlusal plane | 56.8 ± 2.5 | 57.8 ± 3.0 | 56.1 | 6.16 |
| Md1 to Md occlusal plane | 64.3 ± 3.2 | 64.0 ± 4.0 | 68.15 | 5.68 |
| Overjet | 3.2 ± .4 | 3.2 ± .6 | 3.25 | 1.33 |
| Overbite | 3.2 ± .7 | 3.2 ± .7 | 2.52 | 0.75 |
| **Soft tissue structure** | | | | |
| Upper lip thickness | 12.6 ± 1.8 | 14.8 ± 1.4 | 11.5 | 1.60 |
| Lower lip thickness | 13.6 ± 1.4 | 15.1 ± 1.2 | 11.0 | 1.58 |

| | | | | |
|---|---|---|---|---|
| Pogonion-Pogonion' | 11.8 ± 1.5 | 13.5 ± 2.3 | 9.8 | 1.32 |
| Upper lip angle | 8 ± 8 | 14 ± 8 | 19.4 | 6.36 |
| **Facial length** | | | | |
| Nasion'-Menton' | 124.6 ± 4.7 | 137.7 ± 6. | 104.5 | 5.64 |
| Upper lip length | 21.0 ± 1.9 | 24.4 ± 2.5 | 15.95 | 1.84 |
| Lower lip length | 46.05± 4.7 | 50.0 ± 4.7 | 34.5 | 2.8 |
| Lower 1/3rd of face | 71.1 ± 3.5 | 81.1 ± 4.7 | 51.5 | 2.76 |
| Overbite | 3.2 ± .7 | 3.2 ± .7 | 2.52 | 0.75 |
| Mx1 exposure | 4.7 ± 1.6 | 3.9 ± 1.2 | 2.5 | 1.0 |
| Maxillary height | 25.7 ± 2.1 | 28.4 ± 3.2 | 16.5 | 2.1 |
| Mandibular height | 48.6 ± 2.4 | 56.0 ± 3.0 | 35.35 | 2.23 |
| **Projections to TVL** | | | | |
| Glabella | –8.5 ± 2.4 | –8.0 ± 2.5 | -4.3 | 2.59 |
| Nasal projection | 16.0 ± 1.4 | 17.4 ± 1.7 | 12.75 | 2.06 |
| Subnasale | 0 | 0 | 0 | 0 |
| A point' | –1 ± 1.0 | –3 ± 1.0 | -2.15 | 1.22 |
| Upper lip anterior | 3.7 ± 1.2 | 3.3 ± 1.7 | 0.2 | 1.79 |
| Mx1 | –9.2 ± 2.2 | –12.1 ± 1 | -12.9 | 2.5 |
| Md1 | –12.4 ± 2.2 | –15.4 ± 1.9 | 16.1 | 2.8 |
| Lower lip anterior | 1.9 ± 1.4 | 1.0 ± 2.2 | -3.4 | 2.78 |
| B point' | –5.3 ± 1.5 | –7.1 ± 1.6 | -13.0 | 3.5 |
| Pogonion' | –2.6 ± 1.9 | –3.5 ± 1.8 | -11.65 | 3.4 |

**Table 2: Analysis of dentoskeletal factors, soft tissue structures, facial length and projections to TVL (True Vertical line) in skeletal class II group**

| | Mean ± SD Females | Mean ± SD Male | Mean class II group | SD class II group |
|---|---|---|---|---|
| **Dentoskeletal factors** | | | | |
| Mx occlusal plane | 95.6 ± 1.8 | 95.0 ± 1.4 | 82.85 | 4.69 |
| Mx1 to Mx occlusal plane | 56.8 ± 2.5 | 57.8 ± 3.0 | 56 | 7.78 |
| Md1 to Md occlusal plane | 64.3 ± 3.2 | 64.0 ± 4.0 | 58.96 | 4.32 |
| Overjet | 3.2 ± .4 | 3.2 ± .6 | 7.45 | 2.16 |
| Overbite | 3.2 ± .7 | 3.2 ± .7 | 2.4 | 1.38 |
| **Soft tissue structure** | | | | |
| Upper lip thickness | 12.6 ± 1.8 | 14.8 ± 1.4 | 11.45 | 1.8 |
| Lower lip thickness | 13.6 ± 1.4 | 15.1 ± 1.2 | 11.15 | 1.38 |
| Pogonion-Pogonion' | 11.8 ± 1.5 | 13.5 ± 2.3 | 10.5 | 1.87 |
| Upper lip angle | 8 ± 8 | 14 ± 8 | 21.45 | 6.9 |
| **Facial length** | | | | |
| Nasion'-Menton' | 124.6 ± 4.7 | 137.7 ± 6 | 106.6 | 7.55 |
| Upper lip length | 21.0 ± 1.9 | 24.4 ± 2.5 | 15.55 | 1.95 |
| Lower lip length | 46.5± 4.7 | 50.0 ± 4.7 | 30.85 | 4.47 |
| Lower 1/3rd of face | 71.1 ± 3.5 | 81.1 ± 4.7 | 51.6 | 5.67 |
| Overbite | 3.2 ± .7 | 3.2 ± .7 | 2.4 | 1.38 |
| Mx1 exposure | 4.7 ± 1.6 | 3.9 ± 1.2 | 3 | 1.77 |
| Maxillary height | 25.7 ± 2.1 | 28.4 ± 3.2 | 16.6 | 2.87 |
| Mandibular height | 48.6 ± 2.4 | 56.0 ± 3.0 | 36.6 | 4.94 |
| **Projections to TVL** | | | | |
| Glabella | –8.5 ± 2.4 | –8.0 ± 2.5 | -6.15 | 2.82 |
| Nasal projection | 16.0 ± 1.4 | –17.4 ± 1.7 | 13.8 | 1.88 |
| Subnasale | 0 | 0 | 0 | 0 |
| A point' | –1 ± 1.0 | –3 ± 1.0 | -1.4 | 0.94 |
| Upper lip anterior | 3.7 ± 1.2 | 3.3 ± 1.7 | 1.35 | 1.53 |
| Mx1 | –9.2 ± 2.2 | –12.1 ± 1 | -11.5 | 2.8 |
| Md1 | –12.4 ± 2.2 | –15.4 ± 1.9 | -19.4 | 2.7 |
| Lower lip anterior | 1.9 ± 1.4 | 1.0 ± 2.2 | -5.8 | 1.7 |
| B point' | –5.3 ± 1.5 | –7.1 ± 1.6 | -16 | 3.2 |
| Pogonion' | –2.6 ± 1.9 | –3.5 ± 1.8 | -14.7 | 3.0 |

**Table 3: Analysis of dentoskeletal factors, soft tissue structures, facial length and projections to TVL (True Vertical line) in skeletal class III group**

| | Mean ± SD Females | Mean ± SD Male | Mean class III group | SD class III group |
|---|---|---|---|---|
| **Dentoskeletal factors** | | | | |
| Mx occlusal plane | 95.6 ± 1.8 | 95.0 ± 1.4 | 81.45 | 3.67 |
| Mx1 to Mx occlusal plane | 56.8 ± 2.5 | 57.8 ± 3.0 | 56.05 | 5.72 |
| Md1 to Md occlusal plane | 64.3 ± 3.2 | 64.0 ± 4.0 | 76.25 | 8.54 |
| Overjet | 3.2 ± .4 | 3.2 ± .6 | -0.85 | 2.8 |
| Overbite | 3.2 ± .7 | 3.2 ± .7 | 1.05 | 0.88 |
| **Soft tissue structure** | | | | |
| Upper lip thickness | 12.6 ± 1.8 | 14.8 ± 1.4 | 12.45 | 2.13 |

| | | | | |
|---|---|---|---|---|
| Lower lip thickness | 13.6 ± 1.4 | 15.1 ± 1.2 | 12.35 | 1.46 |
| Pogonion-Pogonion' | 11.8 ± 1.5 | 13.5 ± 2.3 | 10.8 | 1.76 |
| Upper lip angle | 8 ± 8 | 14 ± 8 | 20.85 | 5.63 |
| **Facial length** | | | | |
| Nasion'-Menton' | 124.6 ± 4.7 | 137.7 ± 6 | 108.25 | 10.0 |
| Upper lip length | 21.0 ± 1.9 | 24.4 ± 2.5 | 15.65 | 3.95 |
| Lower lip length | 46.5± 4.7 | 50.0 ± 4.7 | 36.6 | 5.12 |
| Lower 1/3rd of face | 71.1 ± 3.5 | 81.1 ± 4.7 | 54.45 | 7.3 |
| Overbite | 3.2 ± .7 | 3.2 ± .7 | 1.05 | 0.88 |
| Mx1 exposure | 4.7 ± 1.6 | 3.9 ± 1.2 | 1 .0 | 0.97 |
| Maxillary height | 25.7 ± 2.1 | 28.4 ± 3.2 | 15.65 | 3.95 |
| Mandibular height | 48.6 ± 2.4 | 56.0 ± 3.0 | 36.45 | 4.76 |
| **Projections to TVL** | | | | |
| Glabella | –8.5 ± 2.4 | –8.0 ± 2.5 | -3.75 | 2.20 |
| Nasal projection | 16.0 ± 1.4 | –17.4 ± 1.7 | 14.05 | 1.731 |
| Subnasale | 0 | 0 | 0 | 0 |
| A point' | –1 ± 1.0 | –3 ± 1.0 | -1.65 | 0.58 |
| Upper lip anterior | 3.7 ± 1.2 | 3.3 ± 1.7 | 1.5 | 1.05 |
| Mx1 | –9.2 ± 2.2 | –12.1 ± 1 | -13.35 | 2.49 |
| Md1 | –12.4 ± 2.2 | –15.4 ± 1.9 | -11.35 | 2.4 |
| Lower lip anterior | 1.9 ± 1.4 | 1.0 ± 2.2 | 1.95 | 1.90 |
| B point' | –5.3 ± 1.5 | –7.1 ± 1.6 | -6.5 | 3.69 |
| Pogonion' | –2.6 ± 1.9 | –3.5 ± 1.8 | -16 | 0 |

## RESULTS

In class I, class II, class III group the maxillary occlusal plane angle showed values of 81.75±5.0, 82.85±4.6, 81.45±3.6 respectively which was statistically significant. In class I group no statistically significant differences were found in other parameters except lower 1/3rd of face with a value of 104.5±5.6 which was statistically significant. In class III group and class II group the mandibular incisor to mandibular occlusal plane angulation was 76.25±8.5 and 58.96±4.32 respectively which was statistically significant. In class II and class III the overjet value was 7.45±2.1 and -0.85±2.8 respectively which was statistically significant, with decreased total facial height, lower 1/3rd face, decreased maxillary height and decreased mandibular height in class II subjects with a value of 106.6±7.5, 51.6±5.7, 16.6±2.8, 36.6±4.9 respectively which were statistically significant. The total facial height, lower 1/3rd face, decreased maxillary height and decreased mandibular height was also found in class III subjects with a value of 108±1.7, 54.4±7.3, 15.65±3.9, 36.45 respectively which were statistically significant, and both hard and soft-tissue projections to true vertical were varying and the statistically significant differences were found in both class II and class III groups. The mandibular incisor to TVL line was -19.4±2.7, point B to TVL was -16±3.2, lower lip anterior to TVL was -5.8±1.7, pogonion to TVL was -14.7±3.0 in class II group and the differences were statistically significant. In class III subjects there were no statistically significant differences in hard and soft tissue projections to TVL in our study as shown in the [Table 1-3].

## DISCUSSION

Orthodontic theory and practice have been based on Angle's paradigm.[1] It is predicted that on a teleological belief system that assumes that when a "natural'' dentitional state of ideal alignment and occlusion occurs, the face should also be in perfect harmony and balance and the stomatognathic system should function ideally. As the time passed it became clear that even an excellent occlusion was unsatisfactory if it was achieved at the expense of proper facial proportions. Not only there were esthetic problems, it often impossible to maintain a stable occlusion by simply pulling the teeth as Angle and his followers had suggested, so a paradigm shift occurred which placed emphasis on clinical examination of intra-oral and facial soft tissues so as to plan ideal soft tissue and then place teeth and jaws as needed to achieve this.[3] Moreover with the introduction of cephalometric radiography, which enabled orthodontists to measure the changes in tooth and jaw positions produced by growth and treatment came into widespread use after world war II. These radiographs made it clear that many Class II and Class III malocclusions resulted from faulty jaw relationships, not just malposed teeth. So during diagnosis and treatment planning of dentofacial deformity, it becomes imperative to focus on hard tissue soft tissue relationships in order to produce ideal occlusion and soft tissue proportions and adaptation at the end of the treatment. So the main purpose of this study was to analyze the role of both hard tissues and soft tissue structures as an aid in diagnosis and treatment planning, so various Parameters like Dentoskeletal factors [Figure 1] have a large influence on the facial profile. These factors, when in normal range will usually produce

a balanced and harmonious nasal base, lip, soft A, soft B, and chin relationship. How accurately the orthodontist and surgeon manage the dentoskeletal components greatly influences the resulting profile.[8,9] In our study dentoskeletal factors were measured in each group, the maxillary occlusal plane angle to TVL was decreased in all the three groups which suggests a steep occlusal plane. However the maxillay incisor and mandibular incisor angulations to the occlusal plane were within the normal range in class I group but the mandibular incisor to occlusal plane angle was decreased in class II group which suggest dental compensation in class II subjects by proclination of lower incisors, similarly the mandibular incisor to mandibular occlusal plane angle showed increased angulation in class III subjects which suggests dental compensation in class III cases by retroclination of lower anteriors with positive and reverse overjet in class II and class III cases respectively. So when discrepancy is mild to moderate and compensations are already less, treatment can be carried out non surgically. Next, soft tissue structures [Figure 2] important to facial aesthetics are measured. The thickness of upper lip, lower lip, and Pog to Pog', alter facial profile. Soft tissue thickness in combination with dentoskeletal factors largely control lower facial aesthetic balance. The nasolabial angle and upper lip angle reflect the position of the upper incisor teeth and the thickness of the soft tissue overlying these teeth. These angles are extremely important in assessing the upper lip and may be used by the orthodontist as part of the extraction decision.[9,10] In our study the soft tissue parameters were within the normal range in all the three groups and no significant differences were found. The facial lengths [Figure 3] are conceptualized as soft tissue facial lengths (upper and lower lip lengths), interlabial gap, lower facial third, and total facial height. Additional essential vertical measurements include: relaxed lip upper incisor exposure, maxillary height (Sn to Mx1 tip), mandibular height (Md1 tip to Me') and overbite.[8,9] The presence and location of vertical abnormalities is indicated by assessing maxillary height, mandibular height, upper incisor exposure, and overbite. In our study maxillary and mandibular heights were decreased but the overbite relationship and maxillary incisor exposure was average in all the three groups with a positive excessive overjet with proclination of lower incisors in class II group and reverse overjet with retroclination of lower incisors in class III group, so the decision whether to extract or not should be based on both hard and soft tissue measurements.

TVL projections [Figure 4] are anteroposterior measurements of soft tissue and represent the sum of the dentoskeletal position plus the soft tissue thickness overlying that hard tissue landmark. The horizontal distance for each individual landmark, measured perpendicular to the TVL, is termed the landmark's absolute value. Although subnasale will frequently be coincident with anteroposterior positioning of the TVL, they are not synonymous. For example, the TVL must be moved forward in cases of maxillary retrusion. Midface retrusion is defined by a long-appearing nose, depressed or flat orbital rims, cheek bones, subpupils, and alar bases, poor incisor support for the upper lip, upright upper lip, thick upper lip, and retruded upper incisor. Clinical examination of the patient is necessary to verify these assessments as described by Arnett and Bergman. In class I subjects the projections to TVL are within normal range but in case of class II subjects the lower incisors and chin point are far behind the true vertical line in our class II group so the decision should be made whether this much of tooth movement can be carried by orthodontics alone or might require surgical correction for correction of deficient chin. In class III subjects the lower incisors are within the normal range but the lower lip anterior and point B are ahead of TVL so the decision must be made whether to correct this discrepancy with orthodontic tooth movement alone without increasing the prominence of the chin or might require surgical correction.

## CONCLUSION

The study was carried as an aid for orthodontists and surgeons for diagnosis and treatment planning whether to go for surgical/ non-surgical decision in different skeletal group. In class I subjects all the parameters are within the normal range so they can be corrected non surgically but in cases of class II and class III subjects there are varying difference in certain parameters, in our study there were many significant differences but they were within the limits of orthodontic treatment which can be camouflaged with dental compensation, but if compensations are already and discrepancy is severe, a surgical option should be considered and treatment guidelines for incisor and occlusal plane angulations, facial length, soft tissue variables, projections to TVL that influence facial outcome are defined for the orthodontist and surgeon depending upon the deviations from normal values. In class II subjects excessive overjet should be corrected without increasing the proclination of lower anteriors and worsening the facial profile by means of upper premolar extraction. Similarly in case of class III subjects excessive retraction of lower anteriors should be avoided to prevent the development of prominent chin and worsening the periodontal status of lower anterior region and if discrepancy is severe surgical option should be considered.

## REFERENCES


1. Ackerman JL: Orthodontics: art, science or trans-science? Angle Orthod 44:243-250, 1974.
2. Park YC, Burstone CJ: soft tissue profile: the fallacies of hard tissue standards in treatment planning, Am J Orthod 90:52-62,1986.
3. Kuhn TS: The structure of scientific revolutions, ed 3, Chicago,1996, University of Chicago Press.
4. Sarver DM: Esthetic orthodontics ad orthognathic surgery, St Louis, 1998, Mosby.
5. Moorrees CFA, Kean MR. Natural head position, a basic consideration in the interpretationof cephalometric radiographs. Am J PhysAnthropol1958;16:213-34.
6. Lundström A, Lundström F. Natural head position as a basis for cephalometric analysis. Am J Orthod DentofacialOrthop1992;101:244-7.
7. Spradley FL, Jacobs J, Crowe DP. Assessment of the anteroposterior soft tissue contour of the lower facial third in the ideal young adult. Am J Orthod1981;79:316-25.
8. Arnett GW, Bergman RT. Facial keys to orthodontic diagnosis and treatment planning. Part I. Am J OrthodDentofacialOrthop1993;103:299-312.
9. Arnett GW, Bergman RT. Facial keys to orthodontic diagnosis and treatment planning. Part II. Am J OrthodDentofacialOrthop1993;103:395-411
10. Holdaway RA. A soft tissue cephalometric analysis and its use in orthodontic treatment planning. Part I. Am J Orthod1983;84:1-28.
11. Holdaway RA. A soft tissue cephalometric analysis and its use in orthodontic treatment planning. Part II. Am J Orthod1984;85:279-93.
12. Steiner CC. Cephalometrics for you and me. Am J Orthod1953; 39:729-55.
13. Baik CY, Ververeidou M: A new approach of assessing sagittal discrepancies: The Beta angle. Am J of Orthod and DentofacialOrthop 2004; 126(1): 100-105
14. Roth R. The Wits appraisal - its skeletal and dento-alveolar background. Eur J Orthod 1982; 4: 21-8




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