ORTHODONTIC DIAGNOSIS, HISTORY, CASE EXAMINATION

Dr Renuka Patel

Introduction

- Orthodontic Diagnosis is established by use of certain clinical implements called diagnostic aid.
- Orthodontic diagnostic aids are use of two types.
- They are the essential diagnostic aids and the supplemental diagnostic aids.

Essential Diagnostic Aids

- They are clinical aids that are considered very important for all cases. The following are the essential diagnostic aids.

1. Case history
2. Clinical examination
3. Study models
4. Certain radiographs
   a) Periapical radiographs
   b) Bite wing
   c) Panoramic
5. Facial photographs

Supplemental Diagnostic Aids

- The followings are supplemental diagnostic aids:

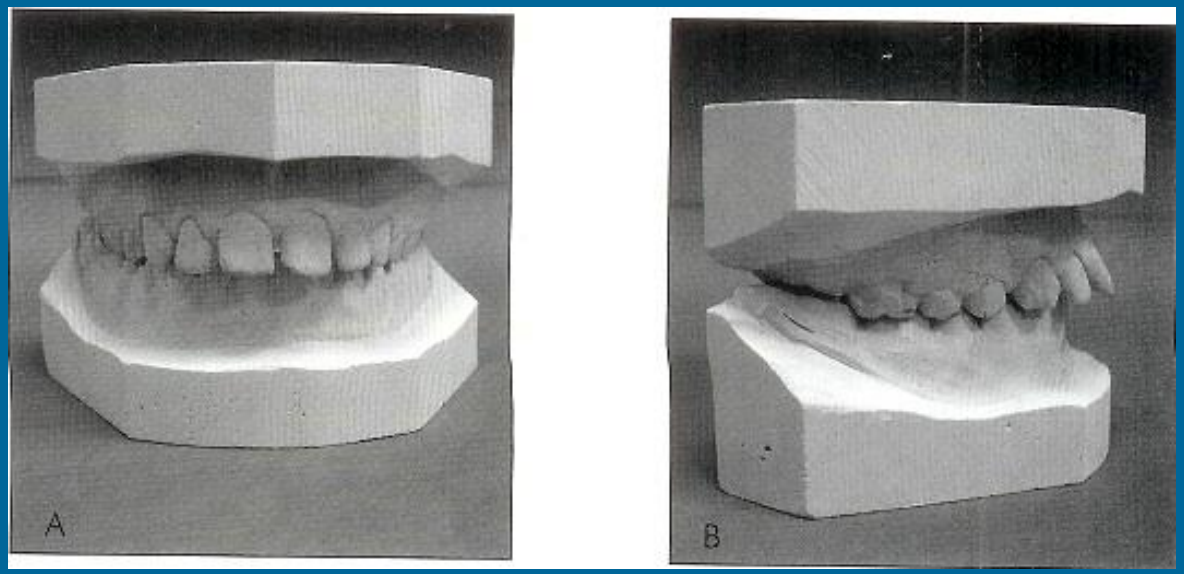
1. Specialized radiographs e.g.
   a. Cephalometric radiographs
   b. Occusal intra – oral films
   c. Selected lateral jaw views
   d. Cone shift technique
2. Electromyographic examination of muscle activity
3. Hand-wrist radiographs to assess bone age or maturation age
4. Endocrine tests
5. Estimation of basal metabolic rate
6. Diagnostic setup
7. Occlusograms

Discussion of two diagnostic Aids

A. Orthodontic Study Models
B. Cephalometric Radiographs

[A]

ORHODONTIC STUDY MODELS



[A] Orthodontic Study Models

- Orthodontic study models are an essential diagnostic records, which helps to study the occlusion and dentition from all three dimensions. They are accurate plaster reproduction of the teeth and their surrounding soft tissues.

Objectives

1. Models accurately reproduce the teeth and their surrounding soft tissues. Soft tissues must not be altered.
2. Models are to be trimmed so that they are symmetrical and pleasing to the eye and so that an asymmetrical arch from can be readily recognized.
3. Models are to be trimmed in such a way that the dental occlusion shows by setting the models on their backs.
4. Models are to be trimmed so that they meet the measurements and angles as proposed for trimming them.
5. Models are to have clean, smooth, bubble- free surface with sharp angles where the cuts meet.

Requirement of study models

a) They are invaluable in planning treatment, as they are the only three dimensional records of the patient's dentition.

b) Occlusion can be visualized from the lingual aspect.

c) They provide a permanent record of the intermaxillary relationship and the occlusion at the start of therapy this is necessary for medico legal considerations.

d) They are a visual aid for the dentist as he monitors changes taking place during tooth movement.

e) Helps to motivate the patient as the patient can visualize the treatment progress.

f) They are needed for comparison purposes at the end of treatment and act as a reference for post treatment changes.

g) They serve as a reminder for the parent and the patient of the condition present at the start of treatment.

h) In case the patient has to be transferred to another clinician, study models are an important record.

Uses of study models

i. Assist and record dental anatomy
ii. Assist and record intercuspation
iii. Assess and record arch from
iv. Assess and record the curves of occlusion
v. Evaluate occlusion with the aid of articulators
vi. Measure progress during treatment
vii. Detect abnormality, e.g. localized enlargements, distortion of arch from, etc.
viii. Calculate total space analysis
ix. Provide record before, immediately, after and several year following treatment for the purpose of studying treatment procedures and stability.

Ideal requisite of study models

- Orthodontic study models should fulfill the following criteria:

i. The models should accurately reproduce the teeth and their surrounding soft tissues with-out any distortion.

ii. The models are to be trimmed in such a manner that they are symmetrical and pleasing to the eye. This enables instant identification of asymmetries in the arch from.

iii. The models are to be trimmed in such a way that when placed on their backs, they accurately reproduce the occlusion.

iv. The study models should have a clean, smooth and nodule free surface.

v. The study models should not only depict the teeth but should also reproduce as much of the alveolar process as possible.

Parts of the study models

- The study models can be divided into two parts for the purpose of description:

i. The anatomic portion

ii. The artistic portion

iii. The anatomic portion is that part which is the actual impression of the dental arch and its surrounding soft structures. This is the part, which must be preserved when trimming the models

iv. The artistic portion is the stone base supporting the anatomic portion. This portion is trimmed in a manner, which depicts, in a general way, the dental arch from and is pleasing to the eye.

Steps of Models Making

a) Impression Making
b) Disinfection Of The Impression
c) Casting The Impression
d) Basing And Trimming Of The Cast
e) Finishing And Polishing

a) ## Impression making:

Obtaining a good impression of the hard and soft tissues of the dento-alveolar region is an important factor in the proper fabrication of orthodontic study casts. Irreversible hydrocolloids (alginate) are widely used for impression making.

b) ## Disinfecting the impression:

The impressions are rinsed thoroughly in water and are disinfected to free them of microorganisms, plaque and other oral secretions that may be present on them. Disinfection can be done be soaking the impression in a disinfected solution such as Biocide.

c) ## Casting the impression :

The impressions obtained are casted using orthodontic stone or model stone. It is beneficial to use some from of vibrator to eliminate incorporation of air bubbles.

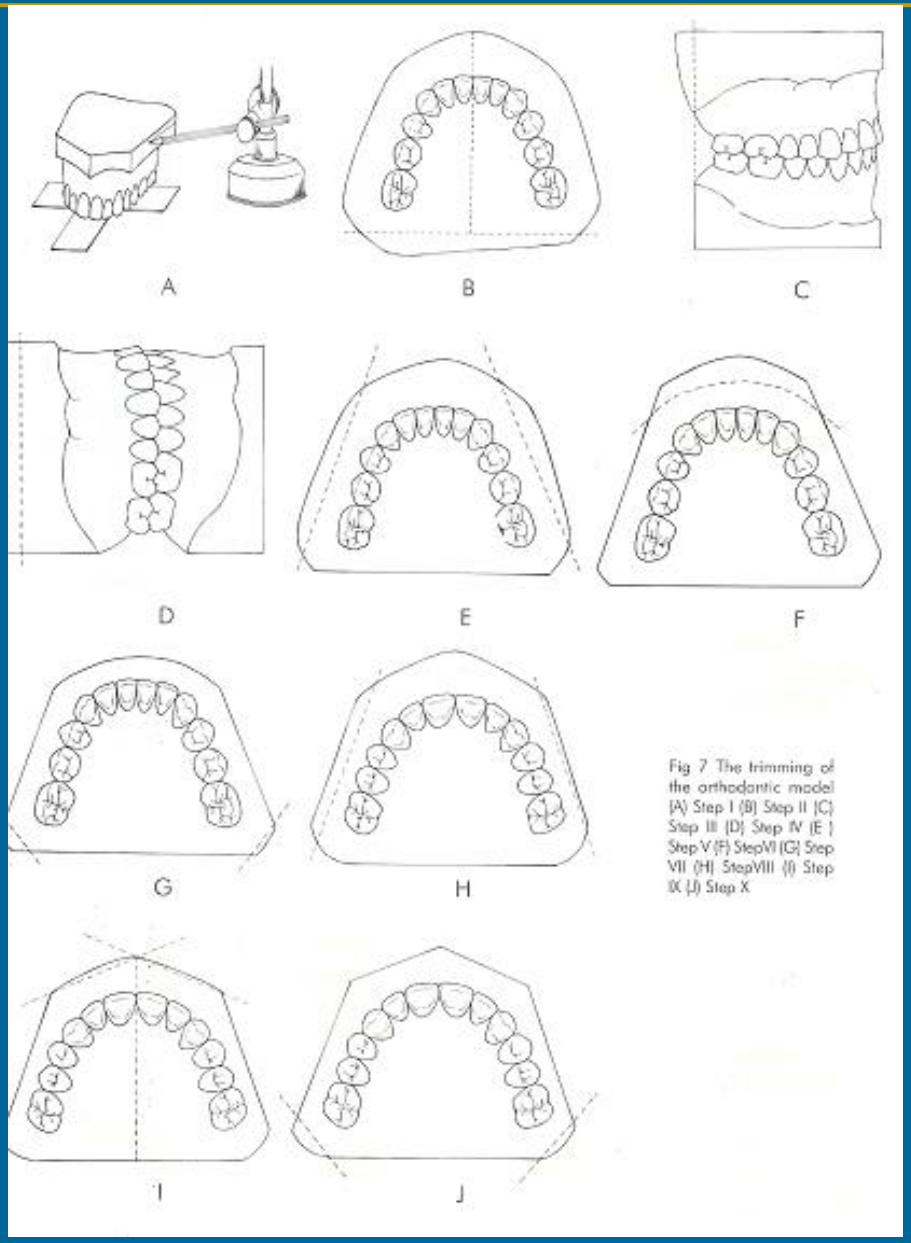


Fig 7 The trimming of the orthodontic model (A) Step I (B) Step II (C) Step III (D) Step IV (E) Step V (F) StepVI (G) Step VII (H) StepVIII (I) Step IX (J) Step X

d) Basing and trimming of cast:

Once the anatomic area of the study models is poured, the artistic portion of the study cast is built to from a base over the anatomic portion. The plaster base is allowed to set for 30-60 minutes. The trimming of orthodontic models is done on an electric plaster trimming machine having a medium-grit carborundum wheel.

e) Finishing and polishing:

The artistic portion of the dental cast is polished using fine grained sand paper. The final polishing of the casts is done by placing them in soap solution for one hour. Models are stored in boxes usually store 2-4 sets of models.

Diagnostic Set Up

The diagnostic set up was first proposed by H.D.Kesling. The diagnostic set up is made from an extra set of trimmed and polished study models. The individual teeth and their associated alveolar processes are sectioned off and replaced on the model base in the desired positions. The diagnostic set up thus helps in stimulating the various tooth movements that are planned for patient.

Uses of diagnostic set up

1. It is useful in visualizing and testing the effect of complex tooth movements and extractions on the occlusion.
2. The patient can be motivated by stimulating the various corrective procedures on the cast.
3. Tooth size – arch length discrepancies can be visualized by means of a set up.

- Procedure

The cast is cut using a fretsaw blade to separate the individual teeth. A horizontal cut is made 3 mm apical to the gingival margin. Vertical cuts are made to separate the individual teeth. The individual teeth are set in desired position using red wax.

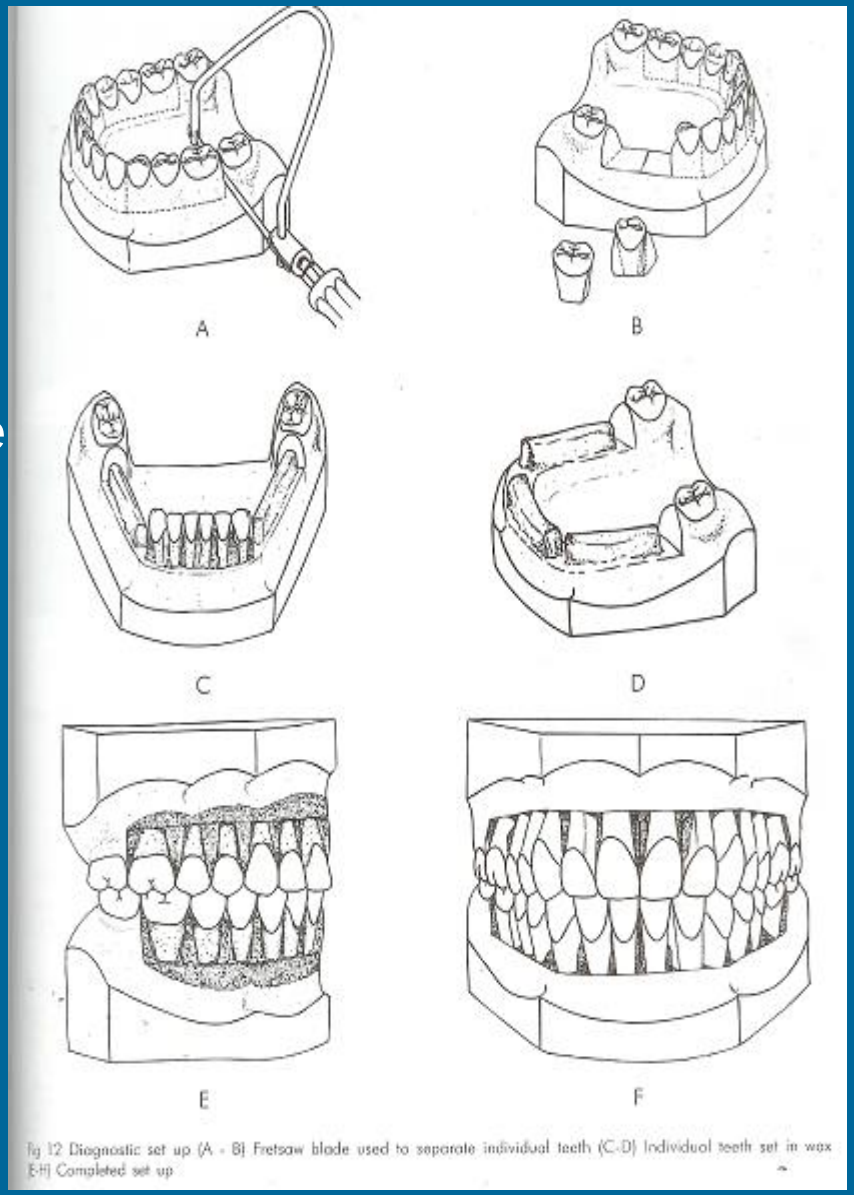
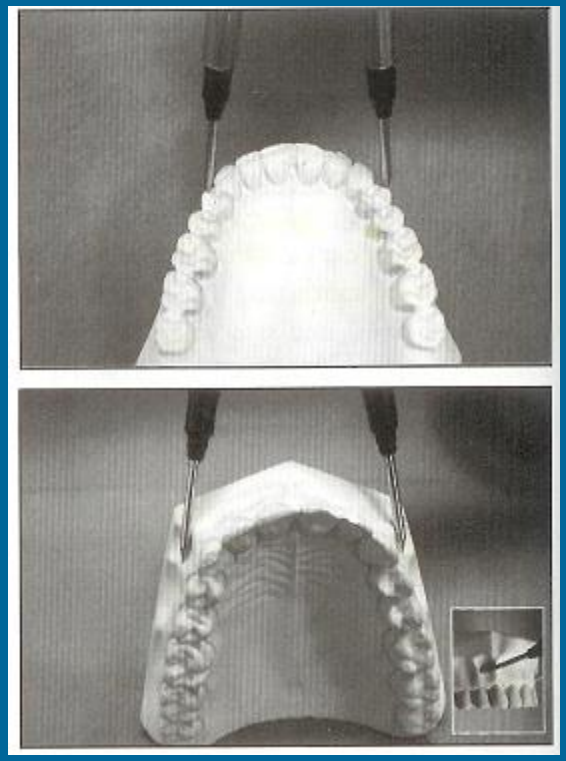


Fig 12 Diagnostic set up (A - B) Fretsaw blade used to separate individual teeth (C-D) Individual teeth set in wax (E-H) Completed set up

ORTHODONTIC STUDY MODEL ANALYSIS

1. Carey's analysis
2. Ashley-how's analysis
3. Ponts analysis
4. Bolton's analysis



1. CAREY'S ANALYSIS

- Shows discrepancy between **ARCH LENGTH** and tooth material
- Performed on lower arch

STEPS

- Determination of arch length
- Determination of tooth material
- Determination of discrepancy
- Inference

Carey's inference	
Discrepancy 0-2.5mm 2.5-5mm >5mm	Inference Proximal stripping Extraction of second premolars Extraction of first premolars

2. ASHLEY-HOWE'S ANALYSIS

- It shows discrepancy between **ARCH WIDTH** and tooth material

STEPS

- Determination of total tooth material (T.T.M.)
- Determination of premolar diameter (P.M.D.)
- Determination of premolar basal arch width (P.M.B.A.W.)

- Inference
  - If PMBAW > PMD; arch expansion is possible
  - If PMBAW < PMD; arch expansion is not possible

$$P.M.B.A.W.\% = \frac{P.M.B.A.W.*100}{T.T.M.}$$

Ashley-Howe's inference	
PMBAW%	Inference
37 or less	Need for extraction
44 or more	Treatment by non extraction
37 to 44	Border lines cases

3. PONTS ANALYSIS

- In 1909, he presented a system where by the measurement of 4 maxillary incisors automatically establishes the width of arch in premolar and molar region

- It helps in

  - Determining whether arch is narrow or normal
  - Determining whether lateral arch expansion is needed or not
  - Determining amount of arch expansion required in premolar and molar region both

- Determination of sum of incisors (S.I.)
- Determination of measured Premolar value (M.P.V.)
- Determination of measured molar value (M.M.B.)

- Determination of **CALCULATED PREMOLAR VALUE**
  This is determined by the formula:
  S.I.* 100/80
- Determination of **CALCULATED MOLAR VALUE**
  This is determined by the formula:
  S.I.*100/64

- Inference
  If measured value is < calculated value, it indicates the need of for expansion

4. BOLTON'S ANALYSIS

The Bolton analysis helps in determining disproportion in mesiodistal width of maxillary and mandibular teeth.

STEPS

- Sum of mandibular 12
- Sum of maxillary 12
- Sum of mandibular 6
- Sum of maxillary 6
- Determination of overall ratio

Determination of overall ratio

According to Bolton the sum of mesio distal width of the mandibular teeth anterior to the second permanent molar is 91.3% the mesio distal width of the maxillary teeth mesial to the second molars.

$$\text{Overall ratio} = \frac{\text{Sum of mandibular 12}}{\text{Sum of maxillary 12}} * 100$$

- If overall ratio < 91.3% , it indicates maxillary tooth material excess.

$$\text{Maxillary 12} = \frac{\text{Mandibular 12}* 100}{91.3}$$

- If overall ratio > 91.3% , it indicates mandibular tooth material excess.

$$\text{Mandibular 12} = \frac{\text{Maxillary 12}* 91.3}{100}$$

Determination of anterior ratio

The sum of mesio distal width of mandibular anteriors should be 77.2 % of the mesio distal width of maxillary anteriors.

$$\text{Anterior ratio} = \frac{\text{Sum of mandibular 6}^{*}\ 100}{\text{Sum of maxillary 6}}$$

- If the anterior ratio < 77.2%, it indicate maxillary anterior excess.

$$\text{Maxillary 6} = \frac{\text{Mandibular 6}^{*}\ 100}{77.2}$$

- If anterior ratio > 77.2% , it indicate mandibular anterior excess.

$$\text{Mandibular 6} = \frac{\text{Maxillary} * 77.2}{100}$$

[B]

CEPHALOMETRIC RADIOGRAPHS

[B] Cephalometric radiographs

- ## Definition

Cephalometric radiography is a standardized method of production of skull radiographs, which are useful in making measurements of the cranium and the orofacial complex. The radiograph thus obtained is called a cephalogram.

- ## Types of Cephalograms

a.) lateral cephalograms

b.) Frontal cephalograms

Uses of Cephalometrics

1. ***Study of craniofacial growth*** serial cephalogram studies have helped in providing information regarding
   - The various growth patterns.
   - The information of standards, against which other cephalograms can be compared.
   - Prediction of future growth.
   - Predicting the consequences of a particular treatment plan.
2. ***Diagnosis of craniofacial deformity*** cephalograms help in identifying, locating and quantifying the nature of the problem, the most important result being a differentiation between skeletal malrelationships.
3. ***Treatment planning*** **by helping** in diagnosis and prediction of craniofacial morphology and future growth, cephalometrics help in developing a clear treatment plan. Ever prior to starting orthodontic treatment an orthodontist can predict the final position of each tooth within a given patient's craniofacial skeleton to achieve aesthetic and more stable results. It helps in distinguishing cases which can be treated with growth modification appliances or which may require orthognathic surgery in future.

4. ***Evaluation of treated cases*** serial cephalograms permit the orthodontist to evaluate and assess the progress of treatment and also helps in guiding any desired change.
5. ***Study of relapse in orthodontics*** Cephalometrics also helps in identifying causes of orthodontic relapse and stability of treated malocclusions. It helps in establishing positions of individual teeth within the maxilla or the mandible, which can be considered to be relatively stable.
6. ***To plan the skeletal repositioning*** **in surgical orthodontics**

LIMITATIONS AND DRAWBACKS OF CEPHALOGRAMS

- 1.The structure being imaged are three dimensional whereas radiographic image is two dimensional.

2. Patient is exposed to ionizing radiation which is harmful,hence it is used only when it is diagnostically and therapeutically desirable.

3.The absence of anatomical references which remain constant with time is a serious disadvantage when need to compare cephalograms taken at different time points.

4. The process of image acquisition as well as measurement procedures are not well standardized.

5. The difficulty in locating landmarks and surfaces on the x-ray image as the image lacks hard edges and well defined outlines.

6. Anatomic structures lying at different planes within the head undergo projective displacement.

7. Patient is positioned with the ear rods in the external acoustic meatus assuming that they are symmetrical but it not need be so.

8.Patient is made to bite in maximum intercuspation while taking the cephalogram but there could be a mandibular shift from centric relation.

9.The composite of lines and angles used in the cephalometric analysis yields limited information about the patient’s dento-skeletal pattern.

10.An orthodontic diagnosis cannot be made solely on the basis of cephalometric analysis.

TECHNIQUE OF CEPHALOMETRIC RADIOGRAPHY

The basic components for producing a cephalogram are:

1. X-RAY APPARATUS comprises of
   a) x-ray tube
   b)transformers
   c)filters
   d)collimators
   e)cooling system all encased in the machine's housing.

2.IMAGE RECEPTOR SYSTEM that consists of

a)an extraoral film
b)intensifying screens
c)cassette grid
d)soft tissue shield

3.CEPHALOSTAT

- it is the head holder and positions the patient's head in three dimensions to receive the x-ray beam.

- The x ray source is placed 5 feet or 60 inches away from the patient's midsagittal plane to reduce the magnification.The film is placed 18 cm away from the midsagittal plane.

- Patient's Frankfort horizontal plane is oriented parallel to the floor by means

  of ear rods inserted to the external acoustic meatuses and the orbitale pointer.

- The upper part of the face is supported by the forehead clamp positioned at the nasion.

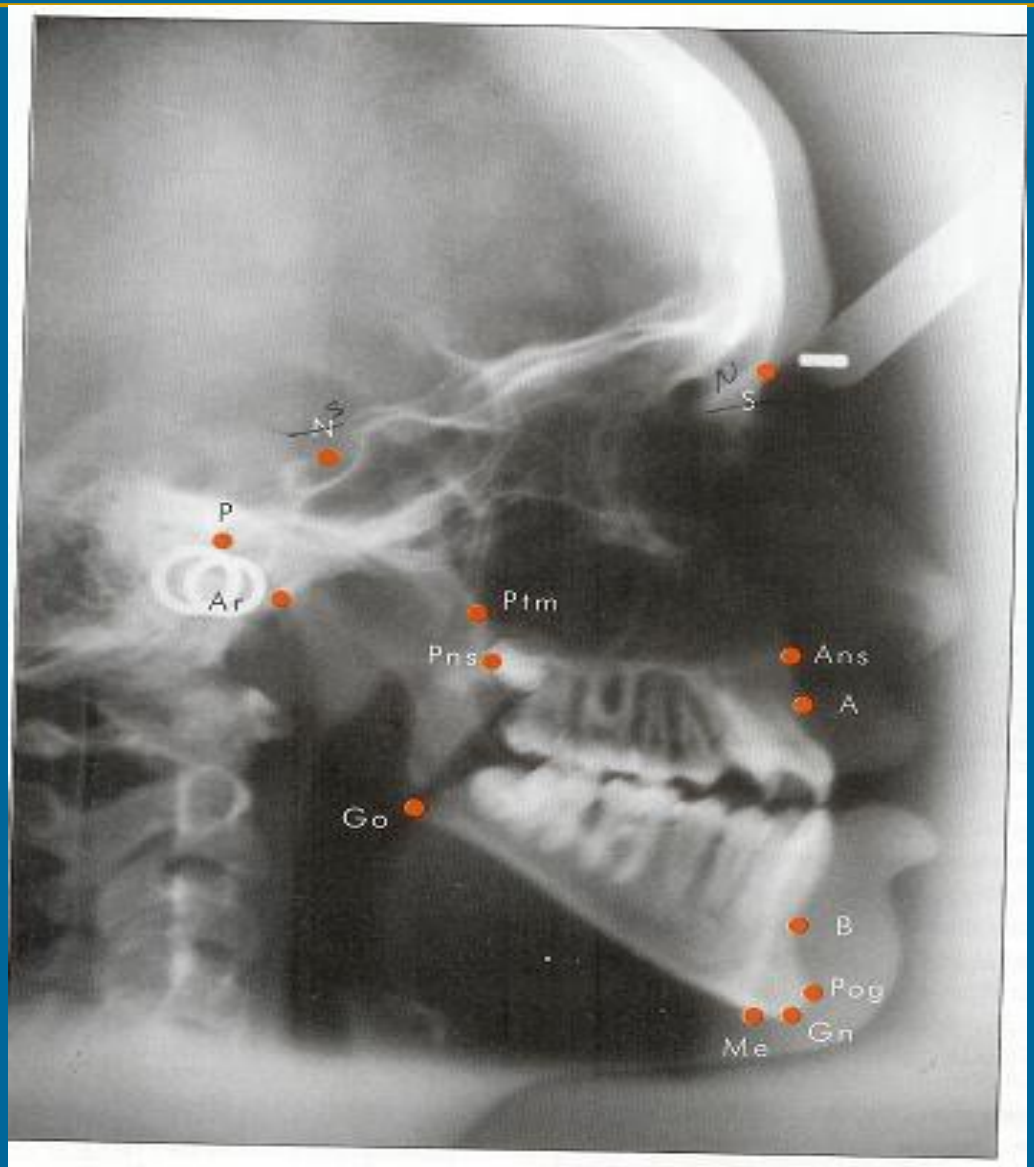


Fig. 3 (A) Important lateral cephalometric landmarks identified on the lateral cephalogram

Cephalometric Landmarks

Cephalometrics makes use of certain landmarks or points on the skull which are used for quantitative analysis and measurements.

The Cephalometric landmarks can be of two types:

Anatomic landmarks

These landmarks represent actual anatomic structures of the skull.

Derived landmarks

These are landmarks that have been obtained secondarily from anatomic structures in a cephalogram.

- The landmarks that are used cephalometrics should fulfill certain requirements.

a. It should be easily seen in a radiograph.

b. It should be uniform in outline and should be reproducible.

c. The landmarks should permit valid quantitative measurements of lines and angles projected from them.

The following are some of the important Cephalometric landmarks.

HARD TISSUE POINTS

a) unilateral points

b) bilateral points

UNILATERAL POINTS

1. ***Nasion:*** The most anterior point midway between the frontal and nasal bones on the fronto-nasal suture.

Anterior nasal spine: It is the anterior tip of the sharp bony process of the maxilla in the midline of the lower margin of anterior nasal opening.

Point A: It is the deepest point in the midline between the anterior nasal spine and alveolar crest between the two central incisors. It is also called subspinale.

Point B: It is the deepest point in the midline the alveolar crest of mandible and the mental process. It is also called Supramentale.

Pogonion: It is the most anterior point of the bony chin in the median plane.

- ***Gnathion:*** It is the most antero -inferior point on the symphysis of the chin. It is constructed by intersecting a line drawn perpendicular to the line connecting menton and pogonion.

- ***Menton:*** It is the most inferior midline point on the mandibular symphysis.

- ***Basion:*** It is the median point of the anterior margin of the foramen magnum

- ***Sella:*** The point representing the midpoint of the pituitary fossa or sella turcica. It is a constructed point in the mid-sugittal plane.

- ***Prosthion:*** The lowest and most anterior point on the alveolar bone in the midline, between the upper central incisors. It is also called supradentale.
- ***Infradentale:*** The highest and most anterior point on the alveolar process, in the median plane between the mandibular central incisors.
- ***Posterior nasal spine:*** The intersection of a continuation of the anterior wall of the pterygopalatine fossa and the floor of the nose, making the distal limit of the maxilla.

- Bilateral points
- ***Orbitale:*** The lowest point on the inferior bony margin of the orbit

- ***Gonion:*** It is a constructed point at the junction of ramal plane and the mandibular plane.

- ***Porion:*** The highest bony point on the upper margin of external auditory meatus.

Bolton point: The highest point at the post condylar notch of the occipital bone.

Condylion: The most superior point on the head of the condyle.

The key ridge: The lower most point on the contour of the anterior wall of the infra- temporal fossa.

- ***Broadbent registration point:*** It is the mid point of the perpendicular from the center of sella tursica to the Bolton plane
- ***Ptm point:*** it is the intersection of the inferior border of the foraman rotundum with the posterior wall of the pterygo - maxillary fissure.

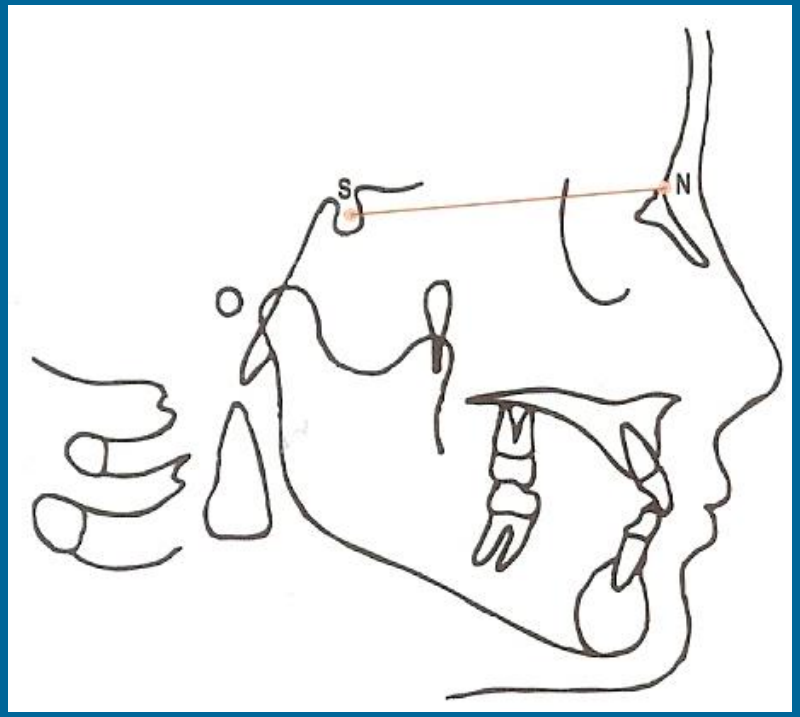
- SOFT TISSUE POINTS
- ***Soft tissue Glabella:*** It is the most prominent point of the forehead in the mid- sagittal plane.
- Soft tissue nasion:Root of the nose in the midline.
- Soft tissue pogonion: Most prominent point in the soft tissue contour of chin.

Lines And Planes In Cephalogram

These lines are obtained by connecting two landmarks. Based on their orientation the lines or planes can be classified into horizontal and vertical.

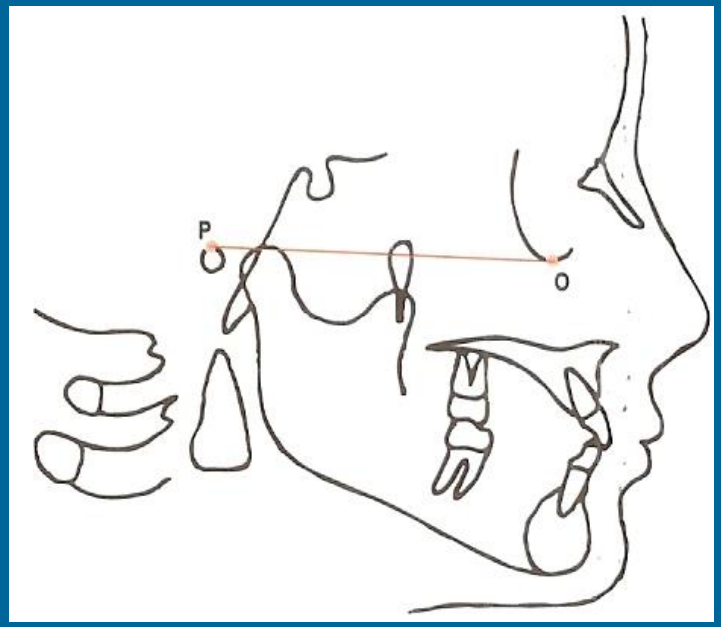
Horizontal planes

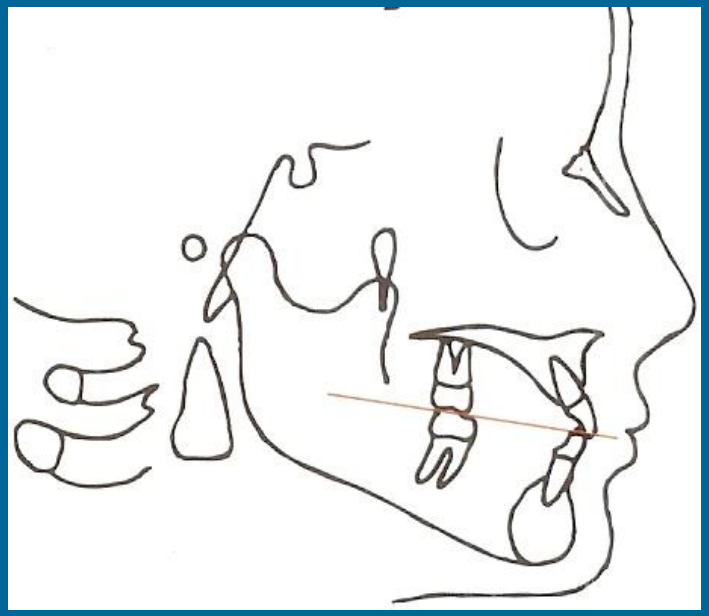
1. **S.N. plane:** It is the cranial line between the center of sella tursica and the anterior point of the fronto- nasal suture. It represents the anterior cranial base.



2. **Frankfort horizontal plane:** This plane connects the lowest point of the orbit and the superior point of the external auditory meatus.

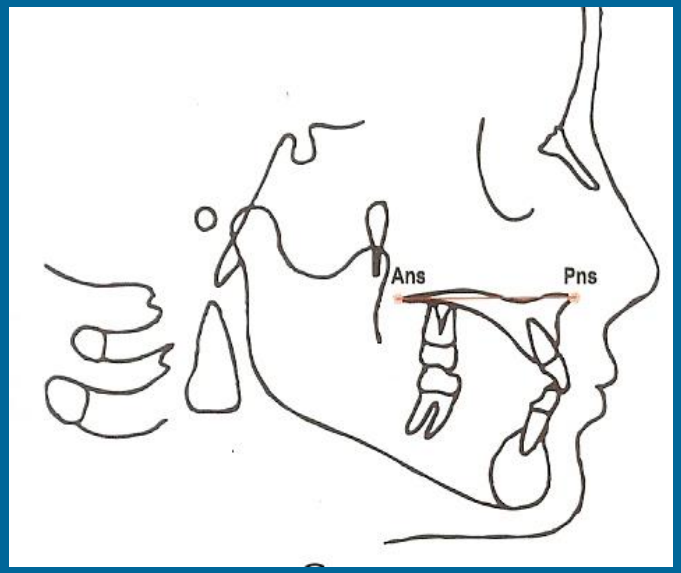
3. **Occlusal plane:** It is a denture plane bisecting the posterior occlusion of the permanent molars and premolars (or deciduous molar in mixed dentition) and extends anteriorly.

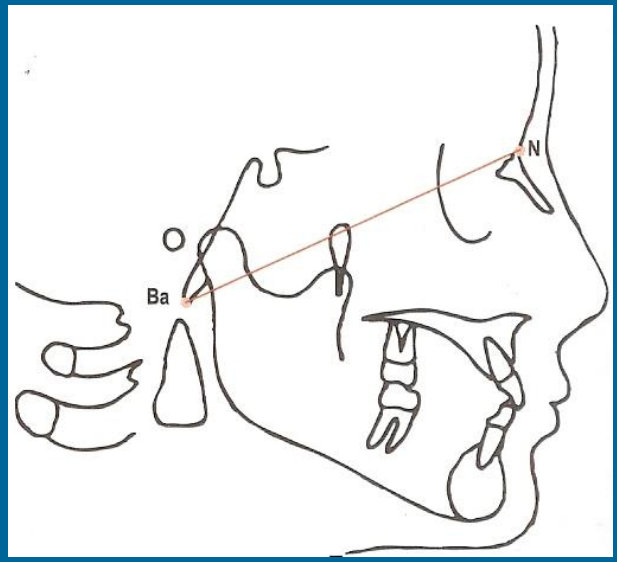




4. **Palatal plane:** It is a line linking the anterior nasal spine of the maxilla and the posterior nasal spine of the palatine bone.

5. **Basion- Nasion plane:** It is a line connecting the basion and nasion. It represents the cranial base.





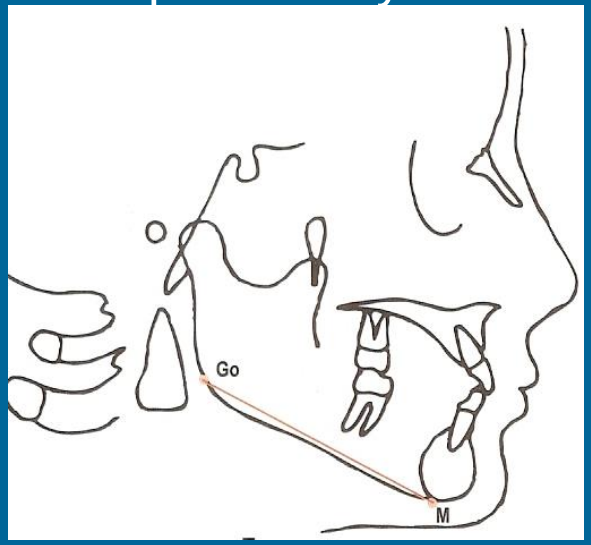
6. Mandibular plane: Several mandibular planes are used in cephalometrics, based on the analysis being done. The most commonly used ones are:

a. Tangent to lower borer of the mandible (Tweed)

b. A line connecting gonion and gnathion (Steiner)

c. A line connecting gonion and menton (Dows)

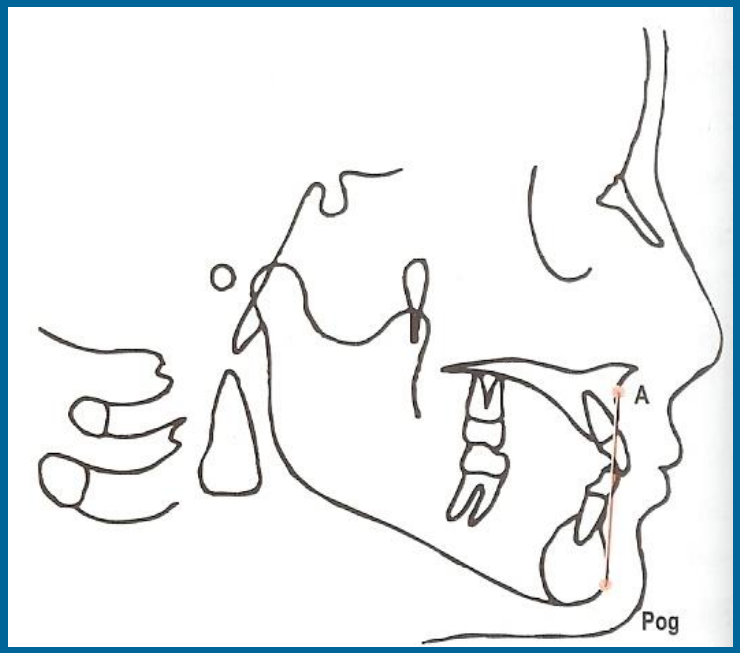
7.Bolton's plane: This is a plane that connects the Bolton's points posterior to the occipital condyles and nasion.

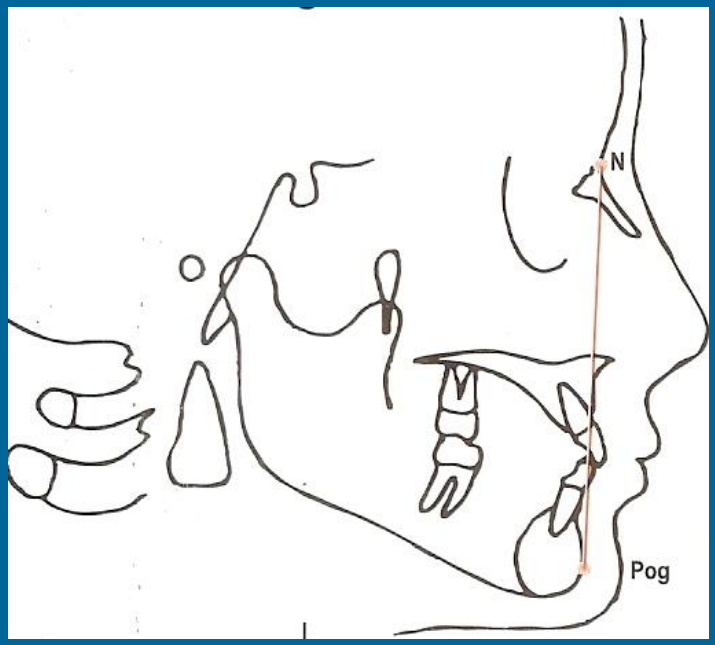


❖ ***Vertical plane***

1. A Pog line: It is a line from point A on the maxilla to pogonion on the mandible.

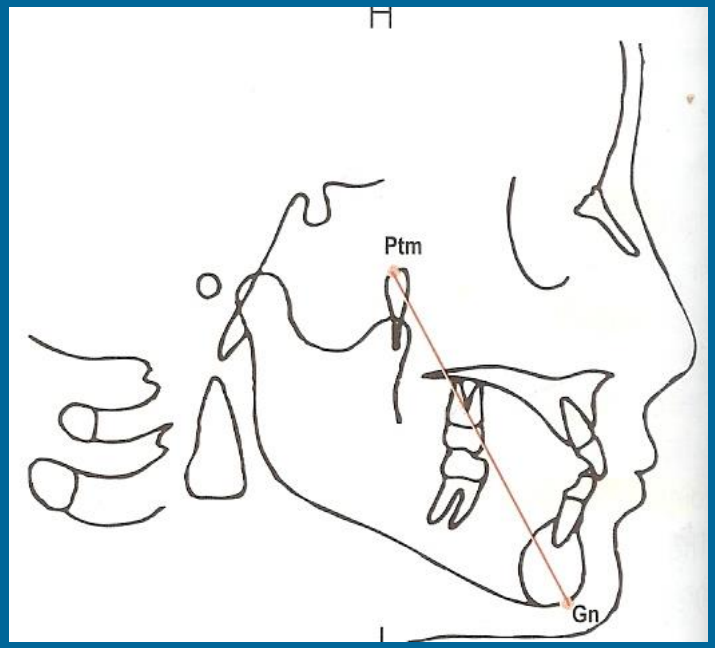
2. Facial plane: It is a line from the anterior point of the fronto- nasal suture to the most anterior point of the mandible.

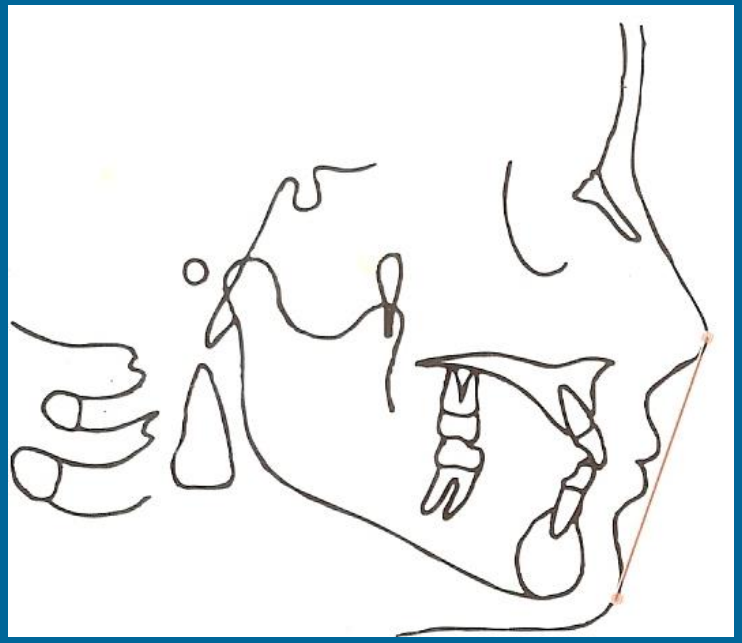




3. Facial axis: A line from Ptm point to Cephalometric gnathion.

4. E. plane: Or the esthetic plane is a line between the most anterior point of the soft tissue nose and soft tissue chin.



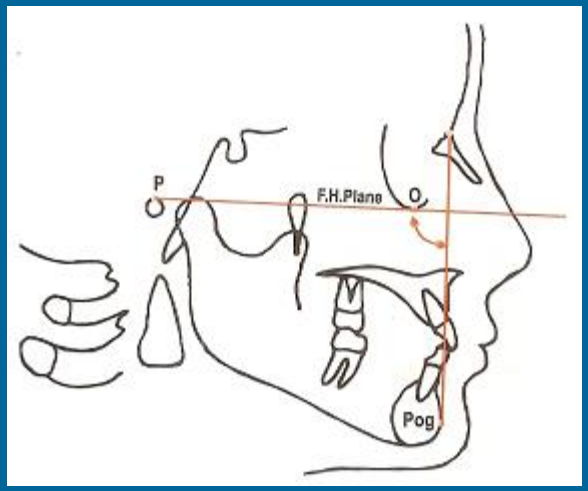


Downs Analysis:

It consist of 10 parameters of which five are skeletal and five are dental.

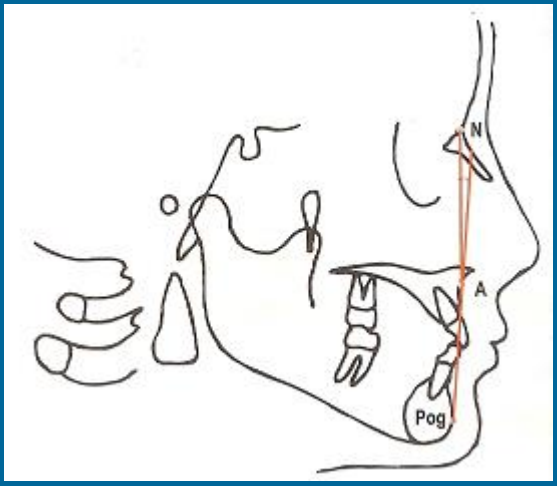
Skeletal Parameters:

1. Facial angle: The average value is 87.8° while the range is 82 to 95°. This angle gives us an indication of the antero- posterior positioning of the mandible in relation to the upper face. The magnitude of this value increases in cases of skeletal Class lll with prominent chin while it decreases in skeletal Class ll cases.

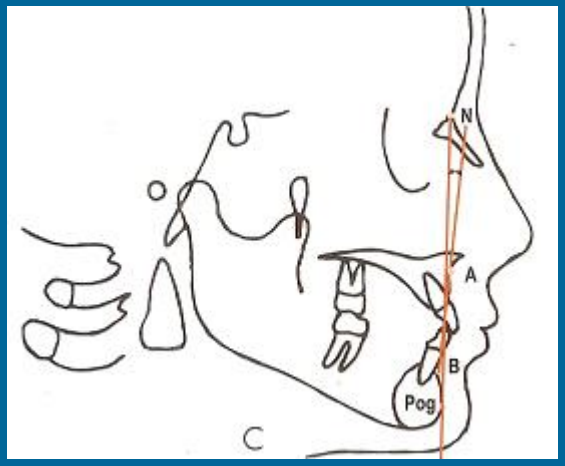


2. Angle of Convexity: This angle reveals the convexity or concavity of the skeletal profile.

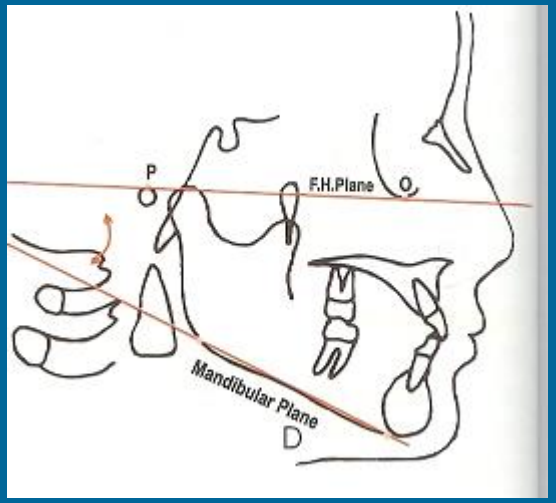
The average value is 0°while the range is between -8.5 to 10°. A positive angle or an increased angle suggests a prominent maxillary denture base relative to mandible. A decreased angle of convexity or a negative angle is indicative of a prognathic profile.



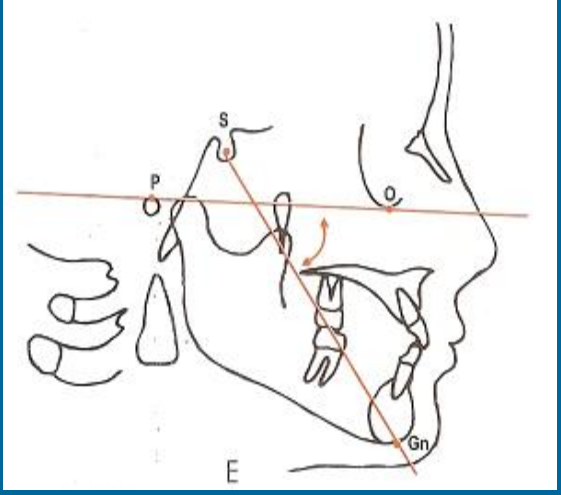
3. A- B plane angle: The mean value is -4.6° while the range is -9 to 0°.This angle is indicative of the maxillo – mandibular relationship in relation to the facial plane. In case of Class lll malocclusions a positive angle may be found.



4. Mandibular plane angle*:* The mean value is 21.9° while the range is 17 to 28°. An increased mandibular plane angle is suggestive of a vertical grower with hyper divergent facial pattern.

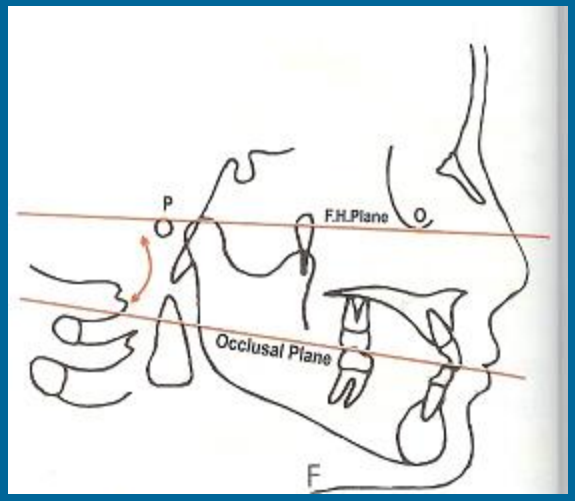


5. Y –Axis (growth axis): The mean value is 59° while the range is 53 to 66°. The angle is larger in class ll facial patterns than in patients exhibiting class lll pattern. If the angle is greater than normal, it indicates greater vertical growth of mandible. If the angle is smaller than normal, it indicates greater horizontal growth of mandible.

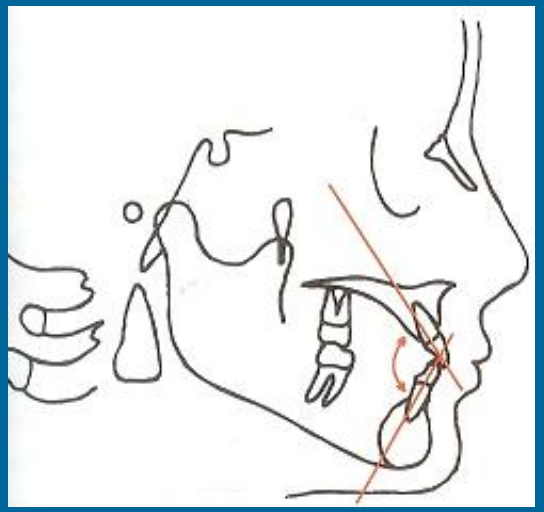


❖ *Dental parameters:*

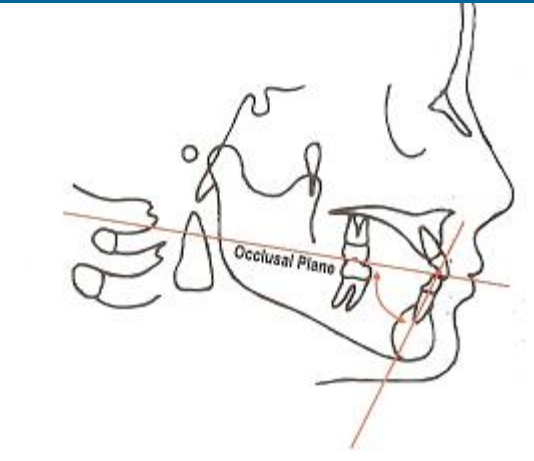
1. **Cant of occlusal plane:** The mean value is 9.3° while the range is 1.5 to 14°. This angle gives us a measure of the scope of the occlusal plane relative to the F.H. plane.



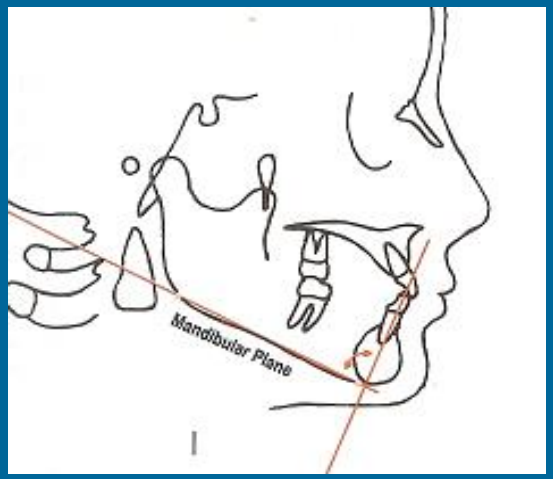
2. Inter – incisal angle: The average reading is 135.4° while the range is between 130 to 150.5°. The angle is decreased in Class I bimaxillary protrusion and Class II, division 1 malocclusion whereas it is increased in a Class II, division 2 case.



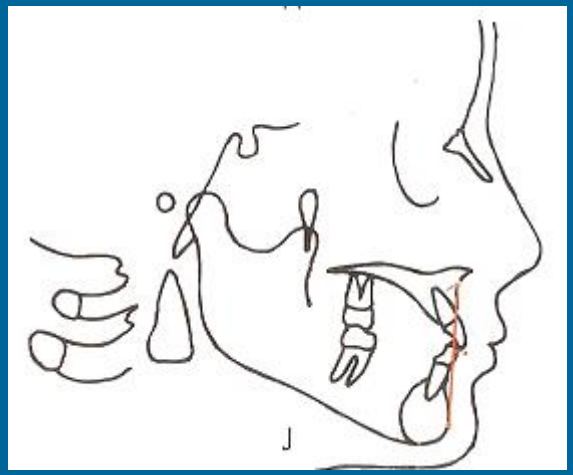
3. Incisor occlusal plane angle: The average value is 14.5° while the range is between 3.5 to 20°. An increase in this angle is suggestive of increased lower incisor proclination.



4. Incisor mandibular plane angle: The mean angulation is 1.4 ° while the range is between -8.5 to 7°. An increase in this angle is indicative of lower incisor proclination.



5. Upper incisor to A- Pog line: This distance is on an average 2.7 mm (range: -1 to 5 mm). The measurement is more in patients presenting with upper incisor proclination.



Variables and norms for Downs analysis

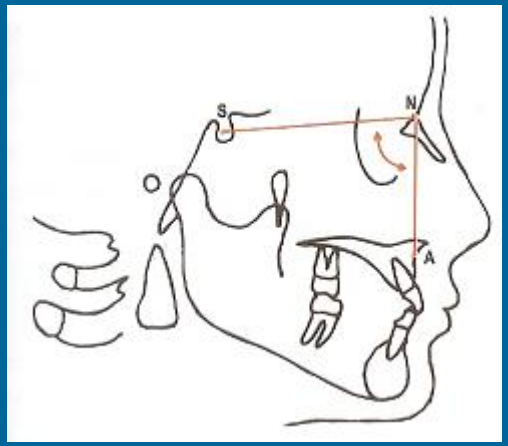
Variable	Mean value	Range
Skeletal		
Facial angle	87.8°	82-95°
Angle for Convexity	0°	-8.5 – 10°
A-B plane angle	-4.6°	-9 – 0°
Mandibular plane angle	21.9°	17-28°
Y- axis	59.4°	53-66°
Dental		
Cant of occlusal plane	9.3°	1.5-14°
Lower incisor to occlusal plane	14.5°	3.5-20°
Lower incisor to mandibular plane	1.4°	-8.7 – 7°
Interincisal angle	135.4°	130-150°
Upper incisor to A- pog	2.7mm	-1 – 5 mm

Steiner Analysis:

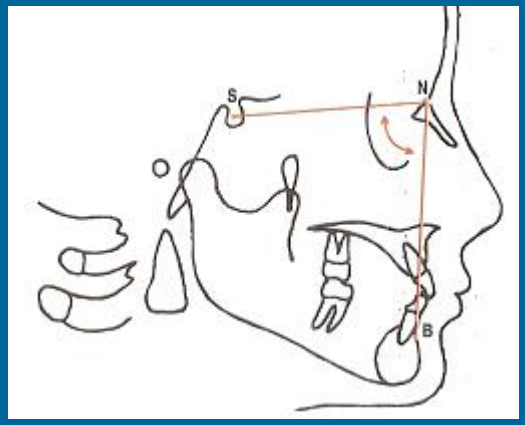
The Steiner Analysis in divided into three parts. They are the skeletal analysis, dental analysis and the soft tissue analysis.

Skeletal Analysis:

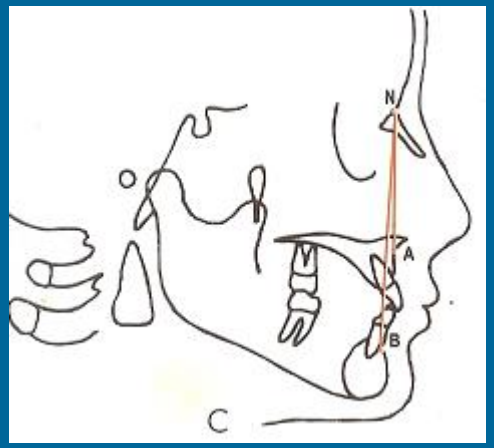
1. S.N.A. angle: This angle indicates the relative antero - posterior positioning of the maxilla in relation to the cranial base. The mean value is 82°. A larger than normal value indicates the=at the maxilla is retrognathic maxilla.



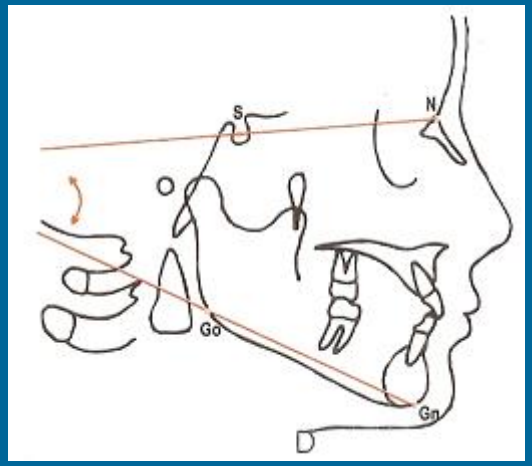
2. S.N.B. angle: This angle indicates the antero- posterior positioning of the mandible in relation to the cranial base. Its average value is 80°. An increase in this angle indicates a prognathic mandible (Class III) whereas a less than normal angle suggest a retrusive mandible (Class II).



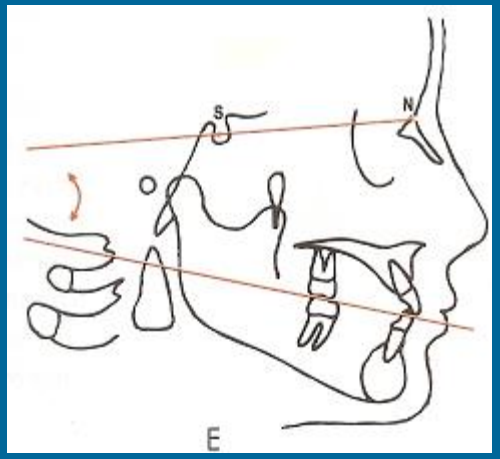
3. A.N.B. angle: It denotes the relative position of the maxilla and mandible to each other. The mean value is 2°. An increase in this angle is indicative of a Class ll skeletal tendency while an angle that is less than normal or a negative angle is suggestive of a skeletal Class lll relationship.



4. Mandibular plane angle: The average value is 32°. This angle gives an indication of the growth pattern of an individual. A lower angle is indicative of a horizontal growing face while an increased angle suggests a vertical growing individual.

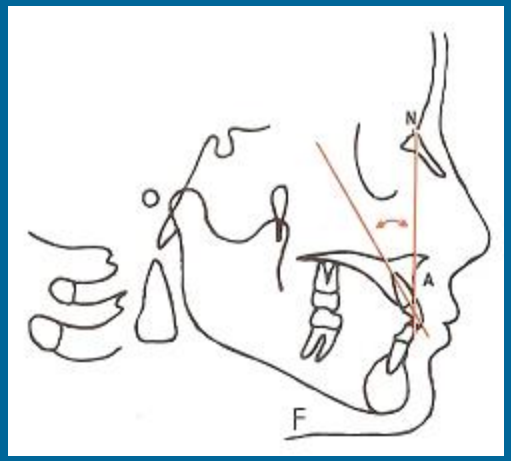


5. Occlusal plane angle: It has a mean value of 14.5°. This angle indicates the relation of the occlusal plane to the cranium and face. It also indicates the growth pattern of an individual.

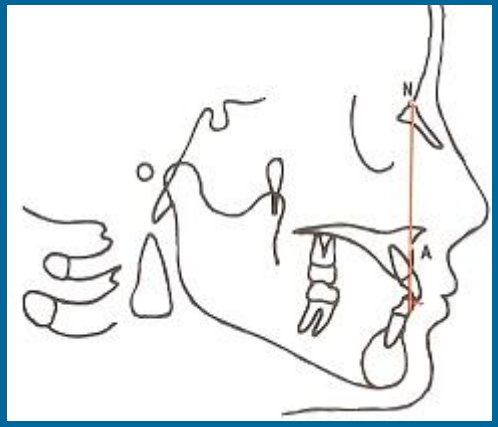


Dental Analysis:

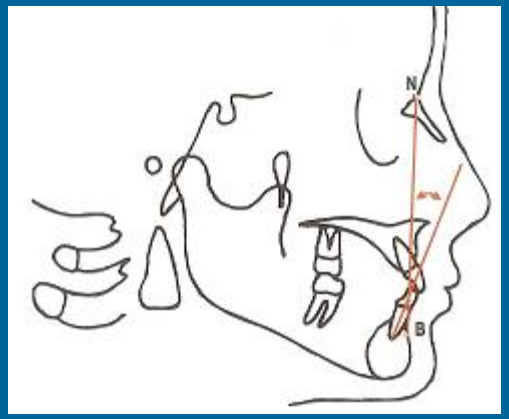
1. **Upper incisor to N-A (angle):** The normal angle is 22°. This angle indicates the relative inclination of the upper incisors. An increased angle is seen in patients who have proclined upper incisors as in Class ll, division 1 malocclusion.



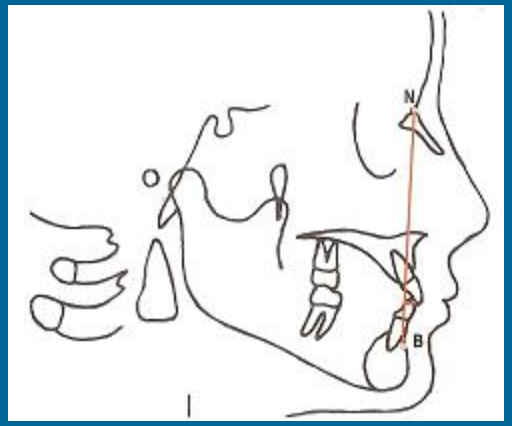
2. Upper incisor to N-A (linear): This measurement also helps in determining the upper incisor position. Normal value is 4mm. It increases in cases with proclined upper incisors.



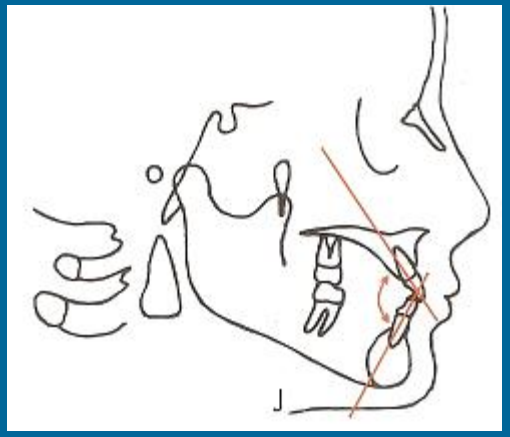
3. Lower incisor to N-B (angle): This angle indicates the inclination of the lower central incisor and has a mean value of 25°. An increased value indicates proclination of the lower incisors whereas a decreased value indicates upright or retroclined lower incisors.



4. Lower incisor to N-B (linear): This measurement helps in assessing the lower incisor inclination. An increase in this measurement indicates proclined lower incisors. The normal value is 4mm.

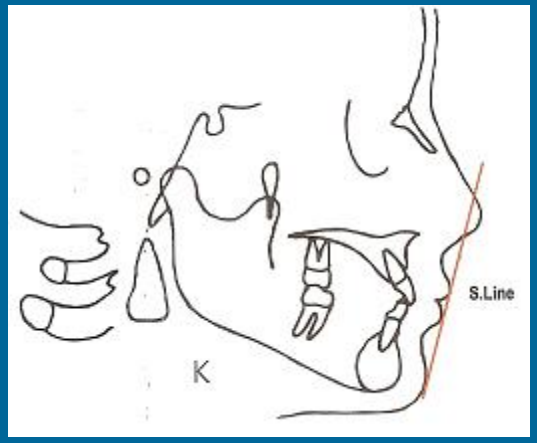


5. Inter- incisor angle: A reduced inter- incisor angle is associated with a Class ll, division 1 malocclusion or a Class I bimax. A larger than normal angle is seen in Class ll, division 2 malocclusion. The mean value is 130 to 131°.



Soft Tissue Analysis:

S line: According to Steiner the lips in a well balanced face should touch a line extending from soft tissue contour of the chin to the middle of an ‘S’ formed by the lower border of the nose. If the lips are located beyond this line then the lips are believed to be protrusive and is interpreted as a convex profile. If the lips are behind this line they are said to be retrusive and the patient may have a concave profile.



Variables and norms for Steiner analysis

Variable	Mean Value
Skeletal	
SNA angle	82°
SNB angle	80°
ANB angle	02°
Occlusal plane angle	14.5°
Mandibular plane angle	32°
Dental	
Upper incisor to NA (angle)	22°
Upper incisor to NA (linear)	4 mm
Lower incisor to NB (angle)	25°
Lower incisor to NB (linear)	4 mm
Interincisal angle	131°

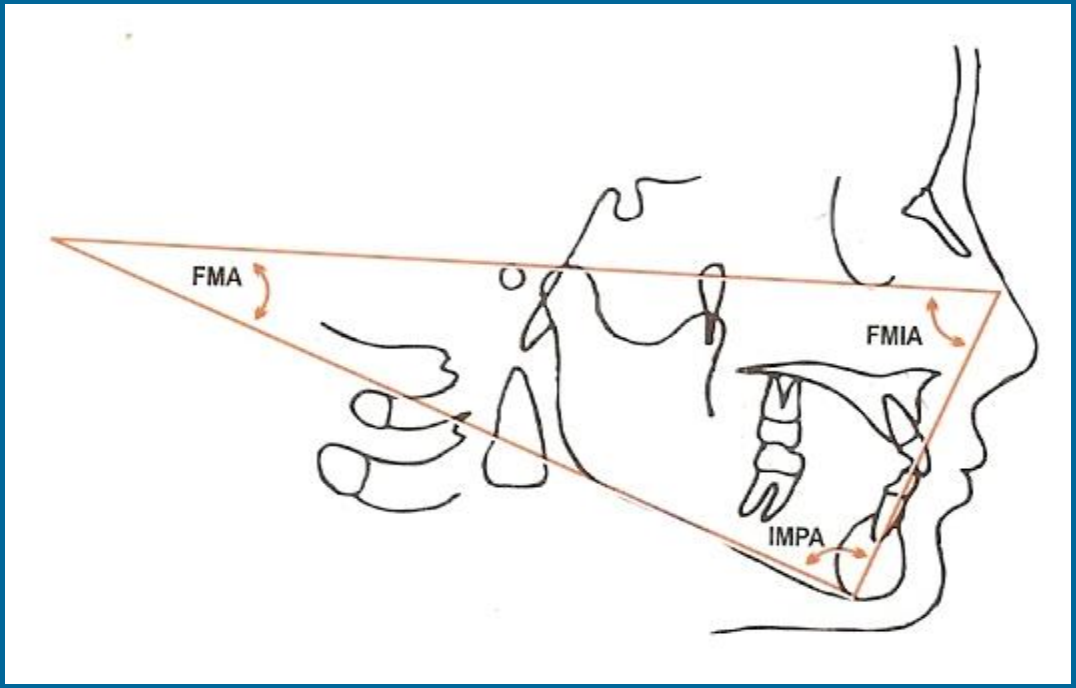
Tweed Analysis:

The Tweed analysis makes use of three planes that form a diagnostic triangle. The planes used are:

a. Frankfort horizontal plane

b. Mandibular plane

c. Long axis of lower incisor.



Variables and norms for tweed analysis		
Variable	Mean value	range
Frankfort mandibular plan angle (FMPA)	25°	16-35°
Incisor mandibular plane angle (IMPA)	90°	85-95°
Frankfort mandibular incisor angle (FMIA)	65°	60-75°

- CLINICAL APPLICATIONS
- Tweed's triangle is used in diagnosis,classification,treatment planning and prognosis.
- Tweed advocated extraction of teeth to correct alveolodental prognathism and to position the lower incisors upright over basal bone.
- When the frankfort mandibular plane angle is in the range of 20 to 30 the prognosis for orthodontic treatment with extractions is excellent to good.

- When the frankfort mandibular plane angle is in the range of 30 to 35 the prognosis for orthodontic treatment with extractions is good to fair.
- When the frankfort mandibular plane angle is in the range of 35 -40 the prognosis for orthodontic treatment with extractions is unfavorable.

WITS APPRAISAL

- The "Wits" appraisal of jaw disharmony is a simple method whereby the severity or degree of anteroposterior jaw dysplasia may be measured on a lateral cephalometic head film.
- The method entails drawing perpendiculars from jaw points A and B on the maxilla and mandible, respectively, onto the occlusal plane.
- The points of contact of the perpendiculars onto the occlusal plane are labeled AO and BO, respectively.

- In a sample of twenty-one male and twenty-five female adults selected on the basis of excellence of occlusion, it was found, on the average, that in females points AO and BO coincided and in males point BO was located 1 mm. ahead of point AO.
- In skeletal Class II jaw dysplasias, point BO would be positioned well behind point AO (positive reading), whereas in Class III skeltal jaw disharmonies, the "Wits" reading would be negative, that is, with point BO ahead of point AO.

HOLDAWAY'S LIP ANALYSIS

- Reed holdaway introduced a quantitative analysis to assess the lip configuration.
- The cephalometric landmarks used are sella,point A and point B.

METHOD:

- Draw a tangent to upper lip from soft tissue pogonion.,this is the "H" line of Holdaway.
- Draw SN plane from SN plane ,drop line to point A and B.
- Measure SNA,SNB,and ANB.

- Measure the angulations between the H line and NB line,this is the “H” angle of Holdaway.
- The perfect profile will meet the following criteria according to him.
- With ANB angle in the range of 1-3, the H angle is 7 -8.
- Lower lip touches the soft tissue line extending from soft tissue pogonion to upper lip.
- The soft tissue line bisects the S shaped curve formed by the lower border of nose to upper lip ,this is an indicator for balance in the relative proportions of upper lip and nose.

ROLE OF CEPHALOMETRICS IN ORTHODONTIC DIAGNOSIS AND TREATMENT PLANNING

The role of cephalometrics for diagnosis and treatment purpose can be divided into four areas:

The parameters used for analysis of anteroposterior relationships are:

1)SNA (Steiner's)

2)SNB (Steiner's)

3)Npog-FH (Down's)

4)ANB (Steiner's)

5)Wits analysis

The parameters used for analysis of vertical relationships are:

1)Ar-Go-Me(Bjork)

2)FMA(Tweed)

3)Sgo:Nme(Jarabak)

4)Mandibular plane angle(Steiner’s)

The parameters for analysis of dentoalveolar relationships:

1)Upper incisor to NA(angular)

2)Upper incisor to NA(Linear)

3)Lower incisor to NB(angular)

4)Lower incisor to NB(Linear)

5)Interincisal angle

VISUALISED TREATMENT OBJECTIVE

There are two types of VTO:

1)Clinical VTO

2)Cephalometric VTO

CLINICAL VTO:

- Clinical VTO was advocated by Creekmore as an aid to decide about the type of appliance in skeletal class 2 relationship.
- Procedure consists of asking the patient to bring the mandible to an edge to edge bite relationship.
- Change in the appearance of the patient is noted at two levels.
- One at edge to edge position and the other at a position midway between the existing occlusion and edge to edge position.

- If the profile worsens at edge to edge position,it means the fault lies in maxilla.it is a case of maxillary prognathismand appliances like maxillary intrusion splint or headgears are advised.
- If the profile improves at edge to edge position ,it means the fault lies in the mandible.it is a case of mandibular retrognathism.functional appliances to stimulate mandubular growth are indicated.
- If the profile improves midway it is a case of combination of maxillary prognathism and mandibular retrognathism .Appliances like activator headgear,twin block with headgears are indicated.

- CEPHALOMETRIC VTO
- A VTO is like a blueprint used in building a house.
- It is a visual plan to predict the normal growth of the patient and the anticipated effects of treatment in order to establish the objectives of treatment for that particular patient.
- VTO permits the development of alternative treatment plan.
- VTO permits an orthodontist to set his/her goals in advance for the treatment
- Ricketts advocated VTO in following sequences:

- Cranial base prediction
- Mandibular growth prediction
- Maxillary growth prediction
- Occlusal plane position
- Location of the dentition
- Soft tissue of the face

Thank you