Cephalometric Tracing
## Cephalometrics

If you expect to find a total solution to your orthodontic problems in cephalometric X-rays or tracings, you are going to be disappointed. If you want a valuable addition to your diagnosis and treatment planning, you can find it in a well-taken and properly analyzed headfilm.

I offer no panacea for your orthodontic problems. Instead, I propose that you find out what the problems are so you can deal with them individually, collectively and intelligently. I will present a systematic procedure for considering these problems and then making decisions regarding their solution. There are seldom definite "Yes" or "No" answers to the problems because you are dealing with human beings and living tissues.

Cephalometrics will display the problems so that you can see them. It gives a set of relative values enabling you to describe, express and communicate the problems with others.

Cephalometrics offers the possibility of predicting the effect of various treatment procedures so you may more intelligently decide on a treatment plan.

### Cephalometric Procedures

**Patient Positioning**

- [ ] Have patient close to normal occlusion
- [ ] Have lips lightly touching
- [ ] Have eyes parallel to the floor

### Kodak T-MAT/G-RA-1 Film

1. Must be used with Kodak X-Omatic cassette with Kodak Lanex Regular Screen (rare earth phosphor screen).
2. X-ray machine setting
   - 10ma  70kvp  1/3 to  4/10
3. Automatic Processor
   - 4 1/2 minutes

### Additional Settings for T-Mat-L Film

- **Hand-Wrist:**
  - 10ma  70kvp  2/10
  - Processor: 4 1/2 minutes
- **Frontal:**
  - 10ma  70kvp  6/10
  - Processor: 4 1/2 minutes

Figure D
Definitions of Cephalometric Landmarks

**Anterior Nasal Spine (ANS)**
The median, sharp, bony process of the maxilla at the lower margin of the anterior nasal opening.

**Gnathion (Gn)**
The lowest point of the median plane in the lower border of the chin. It is a point on the bony border palpated from below and naturally lies posterior to the tegumental border of the chin. In cephalometrics it is the midpoint between the most anterior and the most inferior points on the bony chin.

**Gonion (Go)**
The lowest, posterior-most, and most outward point of the angle of the mandible. It is obtained in cephalometrics by bisecting the angle formed by tangents to the lower and the posterior borders of the mandible. When both angles appear on the profile roentgenogram, the point midway between the right and left side is used.

**Menton (M)**
The lowest point from which face heights are measured. *(see also Gnathion)*

**Nasion (N)**
The middle point on the frontonasal suture. The point at the root of the nose intersected by the median sagittal plane. The root of the nose corresponds to the frontonasal suture, but it is not always the lowest point of the forsum of the nose.

**Occlusal Plane (Occ Pl)**
The occlusal plane of the teeth. A line drawn between points representing one-half of the incisor overbite and one-half of the cusp height of the last occluding molars.

**Orbital (O)**
The lowest point on the margin of the orbit. Since this point varies person to person, and even in the same subject, the orbital point in orthodontic measurement usually is accepted as the point on the lower margin of the orbit directly below the pupil when the eye is open and the patient is looking straight ahead.

**Pogonion (P)**
The most anterior, prominent point on the chin.

**Point (A)**
A measuring point taken at the innermost curvature from the maxillary anterior nasal spine to the crest of the maxillary alveolar process. This point signifies the approximate junction of the basal maxillary bone and the alveolar bone.

**Point (B)**
A measuring point on the anterior profile curvature from the mandibular anthropometric landmark, pogonion, to the crest of the alveolar process. This most posterior point usually falls just anterior to the apices of incisor teeth and divides the basal and alveolar bone.

**Point (D)**
A measuring point located in the center of the mandibular symphysis in an antero-posterior relationship.

**Porion (Po)**
The midpoint on the upper edge of the external auditory meatus. As a cephalometric landmark, it is located by means of the metal rods of the cephalometer.

**Posterior Nasal Spine (PNS)**
Process formed by the united projecting ends of the posterior borders of the palatine processes of the palatal bones.

**Pterygomaxillary (Ptm)**
The point where the pterygoid process of the sphenoid bone and the pterygoid process of the maxilla form the pterygomaxillary fissure. The lowest point of the opening is used in cephalometrics.

**Sella-Nasion A Point (SNA) (subspinal)**
Anteroposterior relationship of the maxillary basal arch to the anterior cranial base. This shows the degree of maxillary prognathism.

**Sella-Nasion B Point (SNB) (supramentale)**
Shows the anterior limit of the mandibular basal arch in relation to the anterior cranial base.

**SNA-SNB (ANB)**
The angle formed by Sella-Nasion A point (subspinal) and sella-nasion B point (supramentale). It indicates antero-posterior relationship of maxillary and mandibular basal arches to the anterior cranial base.

**Sella Turcica (S)**
The pituitary fossa of the sphenoid bone.

**Y-Axis**
A line connecting the geometric center of the Sella Turcica with the Gnathion. This is the vector of downward and forward growth of the face beneath the cranium.
The cephalometric radiograph is routinely traced with the profile facing to the right. Place a piece of acetate tracing paper on top of the x-ray with the dull side of the acetate paper facing you. Make sure it is lined up even with the x-ray. Use two pieces of masking tape about one inch long and place one piece on the upper left of the acetate sheet and the other one on the upper right side. Fold the free end of the tape down and seal to the the back of the ceph. The acetate paper and the x-ray are now sealed to each other at the top, and open at the bottom. This allows you to lift the tracing paper up frequently during the tracing to check landmarks and points directly from the radiograph.

1. Trace the soft tissue profile with a sharp pencil. Draw one continuous line, without erasures if possible.

2. Draw in the anatomical landmarks in the following order:
   - frontal process
   - nasal process
   - orbit of the eye
   - maxillary and mandibular central incisor (use Steiner template)
   - maxillary and mandibular first molar (use Steiner template)
   - anterior nasal spine
   - palatal plane
   - pterygomaxillare fissure (teardrop)
   - mandibular symphysis
   - mandibular border (Ramus)
   - occipital process
   - porion (mechanical)
   - sella turcica

3. Locate and label the cephalometric landmarks and points as follows:
   - Sella - (S)
   - Nasion - (N)
   - Point A - (A)
   - Point B - (B)
   - Pogonion - (P)
   - Menton - (M)
   - Gnathion - (Gn)
   - Point D - (D)
   - Gonion - (Go)
   - Porion - (Po)
   - Posterior Nasal Spine - (PNS)
   - Orbitale - (O)
   - Anterior Nasal Spine - (ANS)
   - Pterygomaxillare Fissure - (Ptm)

4. Draw the planes and lines as follows:
   - SN line (extend off the acetate paper)
   - NA line (extend 1-2 mm below the incisal edge of upper central)
   - NB line (extend to border of mandible)
   - ND line (extend to point D only)
   - GoGn line (extend off the acetate paper)
   - S-Gn line (point to point)
   - Long axis of upper incisor line (extend from SN line past incisal edge)
   - Long axis of lower incisor line (extend from the mandibular border past incisal edge)
   - Occlusal plane line (bisecting molars and centrals)
   - A-P line (point to point)
   - L is a point on the SN line perpendicular to Pogonion
   - facial esthetic line (Soft tissue - tip of chin through middle of nose)
   - draw chevron in front of lips

5. Measure and record your findings in the following order:
   - SNA angle
   - SNB angle
   - ANB difference
   - SND angle
   - GoGn to SN angle
   - Occlusal plane line to SN angle
   - Y axis angle
   - SL measured in mm
   - Long axis of upper incisor to long axis of lower incisor angle (inter-incisal angle)
   - Upper incisor long axis line to NA line angle
   - Lower incisor long axis line to NB line angle
   - NA line to most labial surface of upper incisor measured in mm
   - NB line to most labial surface of lower incisor measured in mm
   - NB to Pogonion in mm
   - AP line to most labial surface of lower incisor in mm
   - Measure Wits in mm. Plus (+) if A is anterior to B. Minus (-) if B is anterior to A.
   - Measure lower face height (LFH) in mm. ANS to Menton, point to point.
Guidelines for Measuring Cephalometric Angles

When measuring angles on a cephal, you should consider three things: two lines and the point at which the two lines intersect. One of these lines will always be the base line. The point where these two lines intersect will always be the base point. The other line will always be the measuring or reading line. Place the base line of your protractor on the base line of the angle to be measured. The 90 degree mark of the protractor should be on the base point. The measurement of the angle is taken from the other line. A protractor is read from 0 degrees at the base line.

<table>
<thead>
<tr>
<th>ANGLES</th>
<th>BASE LINE</th>
<th>BASE POINT</th>
<th>READING LINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNA Angle</td>
<td>SN</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td>SNB Angle</td>
<td>SN</td>
<td>N</td>
<td>NB</td>
</tr>
<tr>
<td>SND Angle</td>
<td>SN</td>
<td>N</td>
<td>ND</td>
</tr>
<tr>
<td>GoGn to SN</td>
<td>SN</td>
<td>--</td>
<td>GoGn</td>
</tr>
<tr>
<td>Occlusal Plane to SN</td>
<td>SN</td>
<td>--</td>
<td>Occlusal Plane</td>
</tr>
<tr>
<td>Y-Axis Angle</td>
<td>SN</td>
<td>S</td>
<td>S-Gn</td>
</tr>
<tr>
<td>Inter-incisal angle</td>
<td>lower incisor long axis line</td>
<td>Point where the 2 lines intersect</td>
<td>Upper incisor long axis line</td>
</tr>
<tr>
<td>Upper Incisor to NA</td>
<td>upper incisor long axis line</td>
<td>Point where the 2 lines intersect</td>
<td>NA</td>
</tr>
<tr>
<td>Lower Incisor to NB</td>
<td>lower incisor long axis line</td>
<td>Point where the 2 lines intersect</td>
<td>NB</td>
</tr>
</tbody>
</table>

Figure E
Diagram for Placement of Measurements

1. SNA angle
2. SNB angle
3. ANB difference (this measurement is also recorded at the center top of the chevron)
4. SND angle
5. GoGn-mandibular plane to SN line
6. Occlusal plane to SN line
7. Y-axis-SGn to SN
8. SL measured in mm
9. Inter-incisor angle-long axis of the upper central incisor
10. Upper incisor long axis line to NA line (angle)
11. Lower incisor long axis to NB line (angle)
12. NA line to the most labial surface of the upper incisor
13. NB line to the most labial surface of the lower incisor
14. NB line to Pogonion measured in mm
15. AP line to the most labial surface of the lower incisor
16. Wits analysis
17. Lower Facial Height-Menton to ANS measured
Anatomical Landmarks
Cephalometric Points & Landmarks
SN Line
NA Line
ND Line
GoGn Line (Mandibular Plane)
S-Gn Line
Long Axis Line upper incisor
Long Axis Line lower incisor
AP Line - Point A to Point P
L is a point on the SN line that is perpendicular (90°) to point P.
Draw a line from the tip of the chin through the center of the nose.
Chevron
SNA = 80°

Place at top of orbit
SNB = 79°

Place in orbit under SNA
ANB = 1°

SNA and SNB difference placed
in orbit under SNB

Also place at top of chevron
Place on top of the palatal process

SND = 77°
GoGn to SN (mandibular plane angle)
Place directly under curvature of the ramus
Ocl. to SN

Place on posterior extension of occlusal plane

\[ 17^\circ \]
Y-Axis = 63°

Place in angle near S
SL = 60 mm

Distance from S to L measured in mm

Place on SN line between S and L
Inter-Incisal = 132°

Upper incisor long axis line to lower incisor long axis line

Place on occlusal plane between incisor and molar
Upper incisor long axis line to NA line
Place on upper inside of the chevron
Lower incisor long axis line to NB line
Place on lower inside of the chevron
Upper incisor to NA = 7mm

Measure in mm from the NA line to the most labial portion of the upper incisor.

Place on upper outside of chevron.
Lower incisor to NB=4mm

Measure in mm from the NB line to the most labial portion of the lower incisor

Place on lower outside of chevron
Pogonion=3mm

Measure in mm from the NB line to point P

Place at bottom of chevron
AP to lower incisor = 2.5mm

Measure in mm from the AP line to the most labial portion of the lower incisor

Place as shown
Wits=-2.0mm

Mark points on the occlusal plane perpendicular to point A and to point B

Measure between points in mm

+ is A Anterior to B
- is B anterior to A

Place in center inside of chevron
Lower facial height = 60mm

Measure in mm from ANS to M

Place above ANS
Kelly Smith
6-1-83
Age 13

AP to P = 2.5mm
Kelli McDaris
9-4-80
Age 17

AP to T = 5mm

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Susie Kelch
11-13-80
Age 22

AP to = -1 mm
Leslie Woodliff
2-27-85
Age 16

AP to T = 4.5mm
Clarissa Armstrong
12-21-88
Age 14.0

AP to $T$ = +3mm
Billie Likowski
05-02-84
Age 8.0