CEPHALOMETRICS

Dept. of Orthodontics

Lateral cephalogram:
- morphology
- cephalometrics:
  - diagnosis
  - growth analysis
  - treatment evaluation
Profile convexity or concavity results from a disproportion in the size of the jaws, but does not by itself indicate which jaw is at fault:

A) Convex profile → Class II jaw relationship, resulting from either a maxilla that projects too far forward or a mandible too far back

C) Concave profile → Class III relationship, resulting from either a maxilla that is too far back or a mandible that protrudes forward

*Proffit 2007
The cranial base, the skeletal mandible, the skeletal maxilla and nasomaxillary complex constitute the basal bone (skeletal) of the upper and lower jaws.

The maxillary & mandibular teeth and alveolar process are functional units (dento-alveolar), which are somehow independent in respect to the maxilla & mandible basal bone.
Different dental and skeletal contributions to malocclusion with same dental relationship
Class II division 1 malocclusion produced by:

The ideal relationships of the facial and dental components

Protrusion of maxillary teeth & normal jaw relationship

*Proffit 2007

Different dental and skeletal contributions to malocclusion with same dental relationship
Class II division 1 malocclusion produced by:

Mandibular deficiency & teeth of both arches almost normally related to the jaws
Different dental and skeletal contributions to malocclusion with same dental relationship

Class II division 1 malocclusion produced by:

- Downward backward rotation of the mandible (e.g. by excessive vertical growth of the maxilla)

Different dental and skeletal contributions to malocclusion with same dental relationship

Class III

- Skeletal
- Dento-alveolar
Objectives of cephalometric analysis

• It is to visualize the contribution of skeletal and dental relationship to the malocclusion

• It is **not** to generate drawings and tables of numbers that are estimators of relationships

• Measurements and other analytic procedures are used to understand dental and skeletal relationships for each **individual** patient
“Old” cephalostat:
anode-film distance = 190 cm
film-head midline distance = 10 cm

“New” cephalostat:
anode-film distance = 150 cm (or less)
film-head midline distance = variable
Distortion on Conventional Lat Ceph
Tracing

Reference structures overview

1. os frontale
2. sinus frontalis
3. os nasale
4. orbita
5. orbita roof
6. medial border of the orbital roof
7. lamina cribrosa ossis ethmoidalis
8. sinus maxillaries
9. processus zygonaticus maxillae
10. anterior limit of fossa cranii media
11. fossa pterygopalatina
12. planum sphenoidale
Reference structures overview

13. tuberculum sellae
14. sella turcica
15. proc. clinoidei ant. et post.
16. dorsum sellae
17. clivus
18. condylus occipitalis
19. proc. mastoideus
20. os occipitale
21. pars nasalis
22. pars oralis
23. canalis mandibulae
Cumulative lateral reconstruction of the facial skeleton

Cumulative frontal reconstruction of the facial skeleton
(posterior part of the cranial base)

maxilla

Alveolar process and apical base

Incisal canal

Nasal floor
Cervical vertebrae

Reference points overview

1. Nasion (n)
2. Sella (s)
3. Pterygo-Maxillare (pm)
4. Spinal point (sp // ANS)
5. Subspinale (ss // Downs’ A-point)
6. Prosthion (pr)
7. Pogonion (pg)
8. Supramentale (sm // Downs’ B-point)
9. Infra Dentale (id)
10. Gnathion (gn)
11. Incision superius (is)
12. Molare Superius (mol. sup.)
13. Incision inferius (ii)
14. Molare Inferius (mol. inf.)
15. Gonion (go)
16. Articulare (ar)
17. Basion (ba)
18. Condylion (cd)
Nasion (n)
- The most anterior point of the fronto-nasal suture -

Sella (s)
- center of the bony cript known as sella turcica -
Pterygo-Maxillare (pm // PNS)
dorsal surface of the maxilla, at the level of the nasal floor
- anterior limit of the pterygo-palatine fossa -

Spinal point (sp // ANS)
- apex of the anterior nasal spine -
Subspinale (ss // Downs’ A-point)
- deepest point of the anterior contour of the upper alveolar arch -

Prosthion (pr)
- lowest and most prominent point on the upper alveolar arch -
**Infradentale (id)**
- highest and most prominent point on the lower alveolar arch -

**Supramentale (sm // Downs’ B-point)**
- deepest point on the anterior contour of the lower alveolar arch -
**Pogonion (pg)**
- most prominent part of the chin -

**Gnathion (gn)**
- lowest point on the mandibular arch -
Incision superius (is)
midpoint on the incisal edge of the most prominent upper incisor

Molare Superius (mol. sup.)
- edge of the distofacial cusp of the upper first molar -
Incision inferius (ii)
midpoint on the incisal edge of the most prominent lower incisor

Molare Inferius (mol. inf.)
- edge of the distofacial cusp of the lower first molar -
Gonion (go)
point on the gonial angle determined by bisection of the tangent angle

Articulare (ar)
intersection between the contour of the external cranial base and the dorsal contour of the condylar head
Basion (ba)  
- projection of the anterior border of the occipital foramen -

Condylion (cd)  
- top of the condylar head -
Reference lines

1. Nasion-Sella Line (NSL)
2. Nasion-Sella Perpendicular (NSP)
3. Mandibular Line (ML)
4. Occlusal Line superior (Ols)
5. Occlusal Line inferior (Oli)
6. Nasal Line (NL)
7. Axis of the upper Incisor (ILs)
8. Axis of the lower Incisor (ILI)
9. Chin Line (CL)
10. Ramus Line (ar-tgo)
11. Sella-Articulare Line (s-ar)
12. Sella-Basion Line (s-ba)

Nasion-Sella Line (NSL)
line joining the nasion (n) to the sella (s)
NATION-SELLA PERPENDICULAR (NSP) line through the sella (s) and perpendicular to NSL

MANDIBULAR Line (ML) tangent to the lower border of the body of the mandible through the gnathion (gn)
OCCLUSAL Line
SUPERIOR (OLs)
line through the incision superius (is) and the molar superius (mol. sup.)

OCCLUSAL Line
INFERIOR (OLi)
line through the incision inferius (ii) and the molar inferius (mol. inf.)
NASAL Line (NL)
line through the spinal point (sp) and the pterygomaxillare (pm)

AXIS of the UPPER INCISOR (ILs)
line connecting the incision superius (is) to the apex of the upper incisor
AXIS of the LOWER INCISOR (ILi)
line connecting the incision inferius (ii) to the apex of the lower incisor

CHIN LINE (CL)
tangent to the chin from infradentale (id)
RAMUS Line (ar-tgo)
tangent to the posterior border of the mandibular ramus through the articulare

SELLA-ARTICULARE LINE (s-ar)
line joining the sella (s) to the articulare (ar)
SELLA-BASION LINE
(s-ba)
line joining the sella (s) to the basion (ba)
CEPHALOMETRICS

- Part II -

Dept. of Orthodontics
1. Sella (s)
2. Nasion (n)
3. Spinal point (sp // ANS)
4. Pterygo-Maxillare (pm // PNS)
5. Subspinale (ss // A-point)
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Reference lines

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12. Sella-Basion Line (s-ba)
Björk - Ceph Analysis

The face in profile.

An anthropological x-ray investigation on Swedish children and conscripts.
• In Björk’s analysis only angular measurements are used ⇒ the magnification factor is thus not important!

• When 2 (or more) lateral cephalograms at different time-point are used to evaluate growth or treatment result the magnification must be the same!

Fig. 1.—Profile radiograph of skull showing structures of the cranial base rendered more distinct by application of 0.5 mm. lead wire and by pointing with a suspension of tantalum powder.
### Sagittal Jaw Relationship

<table>
<thead>
<tr>
<th>Sag. Jaw Relationships</th>
<th>(Cranial Relationships) A</th>
<th>B</th>
<th>C</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Diagram]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Notes:
- ANB
- Max. Prognathism: 1 to 1
- Mand. Prognathism: 1 to 1
- Basal: A to B

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<th>Sag. Jaw Relationships</th>
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### SAGITTAL JAW RELATIONSHIP

<table>
<thead>
<tr>
<th>Sag. Jaw Relationships</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>a: m-nog</td>
<td>$3^\circ$</td>
<td>$2.5^\circ$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b: n-ism</td>
<td>$5^\circ$</td>
<td>$2.5^\circ$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Prognathism</td>
<td>$40^\circ$</td>
<td>$3.5^\circ$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mand. Prognathism</td>
<td>$3^\circ$</td>
<td>$3^\circ$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### DENTO-BASAL RELATIONSHIP

<table>
<thead>
<tr>
<th>II Order (Dento-basal Relationships)</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Alv. Protrusion</td>
<td>$95^\circ$</td>
<td>$8^\circ$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mand. Alv. Protrusion</td>
<td>$70^\circ$</td>
<td>$6^\circ$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Inc. Inclination</td>
<td>$110^\circ$</td>
<td>$6^\circ$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mand. Inc. Inclination</td>
<td>$114^\circ$</td>
<td>$9^\circ$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The three main causes of maxillary overbite (positive horizontal overbite) shown by broken line:
1. Relative difference in basal prognathism
2. Relative difference in alveolar prognathism
3. Inclination of the incisors

VERTICAL JAW RELATIONSHIP
## VERTICAL JAW RELATIONSHIP

<table>
<thead>
<tr>
<th>Max. Zone</th>
<th>LNL/OLNL</th>
<th>Max. Inclination</th>
<th>NEL/NL</th>
</tr>
</thead>
<tbody>
<tr>
<td>10°</td>
<td>4°</td>
<td>8°</td>
<td>3°</td>
</tr>
<tr>
<td>20°</td>
<td>5°</td>
<td>33°</td>
<td>6°</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VERTICALLY</th>
<th>Dento-alveolar</th>
<th>Vert. Zone</th>
<th>LNL/OLNL</th>
<th>Mand. Inclination</th>
<th>NEL/NL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical</td>
<td></td>
<td>20°</td>
<td>6°</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Diagram: A diagram showing the relationship between various anatomical landmarks and their inclinations.
**CRANIAL BASE RELATIONSHIP**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Craniol Base</td>
<td>n-s-snr</td>
<td>124°</td>
<td>5°</td>
<td></td>
</tr>
<tr>
<td>Craniol Base</td>
<td>n-s-a-b</td>
<td>131°</td>
<td>4.6°</td>
<td></td>
</tr>
</tbody>
</table>

**MANDIBLE MORPHOLOGY**

<table>
<thead>
<tr>
<th>Mand. Morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) $\beta$-Angle (to uv)</td>
</tr>
<tr>
<td>19°</td>
</tr>
<tr>
<td>b) Jaw Angle</td>
</tr>
<tr>
<td>126°</td>
</tr>
</tbody>
</table>
anterior

Anterior
posterior

posterior
BJØRK ANALYSIS

Column M: gives the mean value, in whole degrees, taken from Björk's investigations.

Standard deviation (σ):

- Results in the range ± 1σ include 68% of the individuals in a normal population.
- Results ranging from M-2σ up to M+2σ include 95% of the population.
- Results of the order M±3σ will include 99.7% of the population.
BJØRK ANALYSIS

Column II: Dento-basal relationships
- Upper part: Dento-alveolar relationship
- Middle part: Sagittal relationship
- Lower part: Vertical relationship

Column III: Cranial relationships
- Upper part: Sagittal relationship
- Lower part: Vertical relationship
BJØRK ANALYSIS

Column IV: Growth Zone

- Middle part: Cranial Base relationship
- Lower part: Mandibular morphology

DYSPLASTIC CHANGES
a change in the dento-alveolar section which accentuates the basal displacement

COMPENSATORY CHANGES
a change in the dento-alveolar section which reduces discrepancies in the occlusion
### Sagittal relationships

- Bjørk Analysis

### Vertical relationships

- Growth zones

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<table>
<thead>
<tr>
<th>BJØRK ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEPHALOMETRIC ANALYSIS</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Sagittal relationships</td>
</tr>
<tr>
<td>Vertical relationships</td>
</tr>
<tr>
<td>Growth zones</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>M</th>
<th>ad</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>M</th>
<th>ad</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.9</td>
<td>2.0</td>
<td>2.1</td>
<td>2.2</td>
<td>2.3</td>
<td>2.4</td>
<td>2.5</td>
<td>2.6</td>
<td>2.7</td>
<td>2.8</td>
</tr>
<tr>
<td>2.9</td>
<td>3.0</td>
<td>3.1</td>
<td>3.2</td>
<td>3.3</td>
<td>3.4</td>
<td>3.5</td>
<td>3.6</td>
<td>3.7</td>
<td>3.8</td>
</tr>
</tbody>
</table>

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| DJØRBKE ANALYSIS - PorDios -

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<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>M</th>
<th>ad</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>M</th>
<th>ad</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>2.2</td>
<td>3.3</td>
<td>4.4</td>
<td>5.5</td>
<td>6.6</td>
<td>7.7</td>
<td>8.8</td>
<td>9.9</td>
<td>10.10</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>OK ab. Pog.</th>
<th>Max. Inc. To upper lip</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>2.2</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>UK ab. Pog.</th>
<th>Max. Inc. To A-Pog</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3</td>
<td>4.4</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>UK inc. inclination</th>
<th>E-plane lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5</td>
<td>6.6</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>UK inc. menis</th>
<th>Facial contour angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.7</td>
<td>8.8</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Sag jaw relation</th>
<th>5-N-Pg</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.9</td>
<td>10.10</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Sag jaw relation</th>
<th>5-N-Sn</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.11</td>
<td>12.12</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>OK zone</th>
<th>NL/OL</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.13</td>
<td>14.14</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>OK zone</th>
<th>NL/ML</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.15</td>
<td>16.16</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Vertical jaw relation</th>
<th>NL/ML</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.17</td>
<td>18.18</td>
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</tbody>
</table>

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<table>
<thead>
<tr>
<th>OTP/Ort.</th>
<th>Vertical Overjet</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.19</td>
<td>20.20</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Horizontal Overjet</th>
<th>Vertical Overbite</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.21</td>
<td>22.22</td>
</tr>
</tbody>
</table>

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### FACILITETE

<table>
<thead>
<tr>
<th>(II Orden)</th>
<th>(III Orden)</th>
<th>(IV Orden)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A B C D E F</td>
<td>G H I J K L M</td>
<td>N O P Q R S</td>
</tr>
<tr>
<td>1. Blæser, sprog     3.5  4.5</td>
<td>5.6  6.7  7.8</td>
<td>8.9 10.11</td>
</tr>
<tr>
<td>2. Blæser, sprog     3.5  4.5</td>
<td>5.6  6.7  7.8</td>
<td>8.9 10.11</td>
</tr>
</tbody>
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**SAMMENFATTING AF CEPHALOMETRISK ANALYSE**

Ons sig, at lægeren er set p.g.a. mandibular rekonstruktion.

**OK har laad material og pec af bortkastning.**