Reliability of A and B point for cephalometric analysis

Angle East
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History

• Orthodontic profession has always attempted to classify malocclusions.

• A-P relationship of the jaws was considered even before Dr Angle introduced his classification system. (Freeman)
Cephalometrics

- 1931: Broadbent introduced cephalometrics. (Broadbent)
- 1931-50’s: Used mainly for research and growth studies.
- 1950s: Brodie, Riedel, Thompson, Wylie, Margolis, Adams, Ricketts, Steiner and others pioneered cephalometric analysis. (Steiner)
- Since the 1960s: Cephalometrics important tool for orthodontic diagnostics.
Cephalometric Studies

- Evaluate geometry of the face and make decisions regarding treatment and limitations imposed by the facial skeleton. (Steiner)

- Simplify complex 3D structure by creating 2D images and breaking down the information into linear and angular measurements. (Trpkova)
Cephalometric Measurement

- Categorize cases: high angle, large ANB
- Evaluate how a case deviates from the norm.
- Measure change that occurred with treatment. (Baumrind et al)
- Give evidence of the effectiveness of treatment. (Steiner)
Shortfall of Traditional Cephalometrics

- Errors from magnification, positioning of the subject, and interpretation. (Moyers)

- Film (sensor) quality, conditions under which measurements are made and training of observer. (Silveria, et al)

- Reproducibility of landmark.

- All Digital 2D cephalometric manufacturers, use different algorithms, which means the image of a patient taken on two different machines will not be the same. (Hatcher)
Cephalometric Shortfalls

- Many landmarks are extremal: chosen by following a contour. (menton and pogonion). These can change due to orientation. (Moyers, et al)

- Depending on the definition, A point and B point position can change.
A and B point definition?

Deepest?

Most Posterior?

Most Posterior?

Deepest?
Analysis

• Downs first to quantify the anteroposterior jaw relationship in 1948 using Nasion, A point and B point.

• Many analysis have incorporated these landmarks, but used different measures (Reidel, Steiner)

• According to Jarabak the Steiner analysis was based on only a few patients.
A point, B point

- SNA, SNB and ANB: commonly used to evaluate anteroposterior jaw relationships.
- Even though there are studies that point out the problems with this measure, it is still used routinely.
- Analysis is accurate only if anterior cranial base is normal in length. If long or short it gives a false sense of the maxillary and mandibular relationship. If Sella is high or low the angular measure is out of the norm.
- What about the landmarks A and B point?
Purpose of Study

- Evaluate the reliability of landmarks A and B point for cephalometric purposes.
CBCT

- Allows us to look at the skull in all three planes.
- More accurate for landmark identification and measurement. (Ludlow, Gubler, et al)
Materials

- 20 consecutive patients, permanent dentition, 12 females, 8 males. Age: 11-52.

- CBCT iCat (Imaging Sciences International, Hatfield, PA),

- Radiograph taken in Natural Head Posture with mandible in SCP.

- Patients deprogramed. Bite registration: Delar wax anterior, close to 1st tooth contact, VPS posterior bite registration. Anterior registration removed for the radiograph.
Methods

- Dolphin Imaging (Dolphin Imaging, Chatsworth, CA): lateral cephalogram, define an analysis consisting of only landmarks Sella, Nasion, ANS, A point, superdentale, mx central incisor; infradentale, B point, pogonion, gnathion, menton and mn central incisor.

- Ivivo 5 Anatamage (Anatomage, San Jose, CA): MPR

- Definitions: A and B point:
  - A Point: The “most posterior” point from ANS to supradentale with the head in Natural Head Posture.
  - B Point: The “most posterior” point from infradentale to pogonion with:
    - Head in “Natural Head Posture” and:
    - Mandible in SCP at first tooth contact.
B point
Midline Michael D. (Invivo 5)
Observations about B Point

- B point is a very reliable landmark for analysis
- Less than 0.5 mm discrepancy when the section moved 5 mm left or right of the midline.
A point
A point Sean D.

Super Class I
Measurement differences? Midline
Which tracing gives useful information?

Midline
Right Central
Left Central
A point MPR Sean D.
Mekhi T.
Midline
#9
Midline A Point
Suggested Bilateral A point position
• In the samples studied the only instances where midline A point was close to representing anterior position of the maxilla was when incisors were very upright. (A point was on the root to the incisor.)

• Even then, the anterior limit of the bone was dorsal and superior to the incisor root.
Discussion

- Lateral cephalograms only way to evaluate skeletal positions from the sagittal for 84 years. Conventional lateral ceph’s by nature measure the midline and superimpositions.

- Conventional B point is a useable reference for defining the position of the mandible.
Discussion

• The A-P position of maxillary base is not well represented by the commonly used midline A point.

• Traditional SNA, SNB can be misleading because the length of the anterior cranial base affects the angular measure to A point and B point.

• 2D lateral cephs often give the illusion of more anterior alveolar bone than is actually present.
Alveolar bone width
Conclusion: B point

- B point is a reasonable representation of the anterior projection of the mandibular base.
- When measured using a seated condylar position gives a realistic measure of A-P position of the mandible relative to the skull.
Conclusion: A point

- As traditionally defined, A point does not represent the maxillary skeletal base.
The bone anterior to the red line has everything to do with muscle origin and support for the base of the nose and nothing to do with the dentition.
Conclusion: A point

- The position of traditional A point is highly variable.
- Often gives a false sense of the A-P position of the maxilla.
- May give a false impression of the volume of bone available to move maxillary incisors in an attempt to correct the occlusion.
Which is the true skeletal relationship?
New definition of A point?: “over the central incisors.”

This is a better representation of the anterior limit of the maxilla
Problem with Bilateral SNA, SNB

• As with midline cephalometrics, variations in anterior cranial base length can alter the apparent A-P relationship of the jaws.

• Nasion is not a broad landmark. The anterior cranial base length may change when moving from the midline to the central incisors.

• Perhaps this new “A point” would work well as a landmark relative to Subnasale vertical in natural head posture. This takes the discrepancies inherent in a varied Cranial Base length out of the picture.

• New norms would need to be established.
Problems with bilateral “A” point

- Requires CBCT:

- Today exposure similar to 2D

- Flex exposure 11 u/s. 2D is 24u/s for pano and 6-8 u/s for ceph.

- Radiation safety is important, but so is being objective about the risks vs benefits.

- Approaching a day when need to justify 2D due to lack to accurate data relative to radiation.
What if CBCT is not available?

• A larger sample may reveal a more appropriate constructed A point.

• From this sample I would suggest choosing a constructed landmark 2 - 3 mm anterior to the central incisor apex would be a more useful choice. (unless the incisors are upright)
Thank you!
Why SCP? Change AP ceph

- MORE ACCURATE DIAGNOSIS.

- B POINT IN MI IS A MEASURE OF THE MANDIBLE RELATIVE TO THE OCCLUSION. SCP ALLOWS A TRUE SKELETAL MEASURE.

- ONLY WAY TO EVALUATE THE TRUE VERTICAL DISCREPANCY.

- OKESSON AND GREMILLION (PAST CHAIR HD/NECK PAIN UFL, DEAN LSU) RECOMMEND ORTHODONTIST USE AN ARTICULATOR FOR MORE ACCURATE DIAGNOSIS.