The relation of maxillary structures to cranium in malocclusion and in normal occlusion

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The relative size and anteroposterior position of the maxilla in relation to the rest of the cranio-facial complex has been one of the major problems dealt with by investigators in the fields of orthodontics and anthropology. Case[1], Angle[2] and Simon[3], all added their contributions to the present day concept of this relationship. One of the most recent studies was made by Bjork[4], who evaluated the prognathism of the Swedish male population. Many conflicting opinions have been put forth in the dental literature concerning the maxilla and its relationship. In view of this fact, this study was undertaken to determine, if possible, the constancy or variation in the relation of maxilla to cranium and mandible.

METHODS.

Oriented head films were taken with a Broadbent-Bolton cephalometer. All of the patients were instructed to place their teeth in occlusion. The usual tracings were made. All bilateral points were recorded and midpoints between these structures were used for measuring. Various angular and linear measurements were recorded, the most important of which will be summarized here.

MATERIALS.

The material chosen for this study consisted of fifty-two adult excellent occlusions, ages eighteen to thirty-six; twenty-four children ages seven to eleven, possessing excellent occlusions; thirty-eight individuals with Class II, division 1 malocclusions, and ten with Class II, division 2 and nine with Class III malocclusions. The statistics on the last two groups mentioned will not be recorded here since they constitute too small a sample. No attempt was made to evaluate these groups on a sex basis. Two base planes were used, the cranial plane sella-nasion and the cranio-facial plane porion-orbital, more properly termed the Frankfort-horizontal plane. The angular recordings to both of these planes will be included in the data to follow. The most interesting figures were summarized in Table I entitled, "Cephalometric Analysis." These figures are particularly applicable in orthodontic case analysis.

The measurements that were felt to be most useful and a discussion of their possible significance follows:

1. As a measure of the relative anteroposterior position of the maxilla, the angle Sella-Nasion to Point A was constructed. Using this measure and others of a similar nature, no significant difference could be found in the anteroposterior relation of the maxilla to the cranial base in patients presenting excellent occlusion and malocclusion of the teeth. There was evidence of a tendency for the maxilla to become more prognathic with growth, when the younger age group was compared with adults.

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[1] Summary of a thesis submitted in partial fulfillment of the requirements of the degree of Master of Science in Dentistry at Northwestern Dental School, Chicago, Illinois, 1948.

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TABLE I

CEPHALOMETRIC ANALYSIS

Planes and Landmarks	*Adults (over 18 yrs.)*		*Children (8-11 yrs.)*	
Skeletal	*Mean °*	*Standard Deviation*	*Mean °*	*Standard Deviation*
Relative anteroposterior position of maxilla S-N-A	82.01	3.89	80.79	3.85
Relative anteroposterior position of mandible S-N-B	79.97	3.60	78.02	3.06
Relation of Maxilla to Mandible Diff. S-N-A S-N-B	+2.04	1.81	+2.77	2.33
Mandibular plane to Sella-Nasion plane NS-Go-Gn	31.71	5.19	32.27	4.67
Angle of convexity N-A-P	+1.62	4.78	+4.22	5.38
Axial inclination of upper central incisors to Sella-Nasion U-1—NS	103.97	5.75	103.54	5.02
Axial inclination of upper central incisors to lower central incisors U-1—L-1	130.98	9.24	130.40	7.24
Axial inclination of lower incisors to mandibular plane L-1—GoGn	93.09	6.78	93.52	5.78
Axial inclination of lower incisors to occlusal plane L-1—OP	69.37	6.43	71.79	5.16
Relation of upper incisors to facial plane U-1—NP mm	5.51 mm	3.15	6.35 mm	2.67
Axial inclination of upper incisors to Frankfort-Horizontal	111.2	5.7	110.0	4.9

2. The relative anteroposterior position of the mandible was measured by the angle Sella-Nasion to Point B, and various other angles not mentioned here. The anteroposterior relation of the mandible to the cranial base was found to be significantly different in patients exhibiting excellent occlusion when they were compared with individuals possessing malocclusion. The most marked difference occurred in Class II, division 1 malocclusions where the mandible was less prognathic than in normal occlusions. Again, there was evidence for a tendency of the mandible to become more prognathic with growth.

3. The relative difference in the anteroposterior relations of Points A and B on the maxilla and mandible appeared to be the most significant finding in this study. This difference is measurable, in part at least, by the difference between the angles S-N-A and S-N-B. In normal occlusions this difference was found to be approximately 2° and in malocclusions to vary considerably. This angle of course may be measured directly as the angle A-N-B.

4. A third measure, thought to be important in orthodontic diagnosis, is that of the relative cant of the mandibular plane to the sella-Nasion line. (NS-GoGn).

5. The angle of convexity, or Nasion - Point A - Point P, is also useful in cephalometric analysis. The mean for adults was +1.6 and for children +4.2, indicating a straightening of the facial profile from childhood to adulthood. Baum[5] confirmed this finding in his recent study.

In the dental area several significant figures have been recorded as follows:

1. The axial inclination of the upper incisors to the sella-nasion plane. Perhaps one of the most overlooked and important relations in cephalometric evaluation is that of the axial inclination of the upper incisors. As indicated in the summary sheet, the inclination of the upper incisors to the sella-nasion plane recorded a mean of 103.5° in both adults and children. Since the upper anterior teeth are probably those which can be influenced least during orthodontic retraction, i.e., rootwise, it might be wise for the orthodontist to give greater consideration to the axial inclination of these teeth. For those who use the Frankfort-horizontal plane in orthodontic diagnosis, it was found that the average axial inclination of the upper central incisors to the Frankfort-horizontal plane was approximately 111° in adults and 110° in children. It was interesting to note that the mean axial inclination of the upper central incisors was 118° in Class II, division 1 malocclusions, a mere 7° more labial in inclination than had been found in the normal adult occlusions.

2. The axial inclination of the upper incisors to the lower central incisors.

3. The axial inclination of the lower incisors to the mandibular plane.

4. The axial inclination of the lower incisors to the occlusal plane.

5. The relation of the upper incisors to the facial plane NP (mm).

6. The inferior posterior angle formed by the intersection of FH to a line drawn from nasion to the tip of the upper incisor in adult normals and Class II, division 1 malocclusions, both had a mean of 93.5°. The angle S-N to the tip of the upper central incisors (S-N-U 1) was 86° in both normal and Class II, division 1 malocclusions. It may be stated, therefore, that the relative anteroposterior relation of maxillary central incisors to cranial base was found not to be significantly different in patients presenting normal and Class II, division 1 malocclusions of the teeth.

7. As a measure of the anteroposterior position of the upper incisor to the facial plane, the millimetric measurement upper incisor to the NP plane was recorded, with an average of between 5.5 and 6.5 mm. anterior to this plane in patients exhibiting normal occlusions. The maxillary incisors were found to be slightly behind this position in Class II, division 2 malocclusions, and far behind this point in Class III malocclusions. In patients exhibiting Class II, division 1 malocclusions, the maxillary incisors were found to be about twice the distance anterior to the facial plane as in patients having normal occlusions.

8. Points A and B appear to bear a highly constant relation to the occlusal plane. A line connecting these points forms about a 90° angle with the occlusal plane in patients exhibiting normal occlusions.

Bearing in mind the relative immobility of the position of the upper anterior teeth, it might be well to begin our cephalometric diagnosis in cases of malocclusion from the position of these teeth. Up until now great stress has been placed upon the various angular relationships of the lower incisors to other planes of the face. From a diagnostic standpoint these relationships and their significance have been exhausted. If those using cephalometric

analysis in the diagnosis and treatment planning of their orthodontic cases will start recording the various relationships that the upper incisors bear to planes of the head they will find them most useful.

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