Problems And Promises Of Basilar View Cephalograms

H. Berger, Dr. Med. Dent.
Tel-Aviv, Israel

Introduction

Cephalometric roentgenology has been in use now for more than thirty years. But through all these years the lateral view only has been utilized. The syllabus by Krogman and Sassouni describes more than forty diagnostic methods, all of them concerning the profile roentgenogram. The authors themselves are aware of this fact, "Generally speaking, in roentgenographic cephalometry, breadths and heights have been relatively neglected in favor of the anteroposterior or depth dimensional changes. Maybe a factor responsible for this situation is the Angle classification. The focus in this classification is put on the anteroposterior relationship of the teeth, the dental arches and sometimes the jaws. It was but natural that the first investigations on facial growth were in turn focussed on the anteroposterior changes and especially their repercussions on the profile."

Schwarz in his recent publication *Die Roentgenostatik* of some hundred pages devotes exactly one third of one page to the "Roentgenvorderbild" (anteroposterior roentgenogram).

It is understandable that at first investigations were concerned with the profile view, where not only changes of growth and development were easily appraised, but also where changes due to treatment could be very effectively demonstrated. However, it seems to the author that the possibilities of the profile view have been greatly exhausted; if we heed Salzmann's admonition, "Cephalometrics is a means of obtaining information; it is not an end in itself", then one might well benefit from looking for new approaches.

That the anteroposterior film has been badly neglected has just been stated, but there is a third view which up to now has never been used at all, the basilar view. Of course, pictures in this view cannot be taken so easily as in the other two directions but on the other hand they are not as complicated either, especially in children who are elastic and flexible.

Roentgenologic Technique of Basilar View Cephalograms

The roentgenologic technique for the basilar view has been described as early as 1905 by Schueller who used the term "Submento - vertical position". He recommended two ways, with the patient either lying on his back or sitting. To ensure complete immobility of the patient, the first method has been adopted in the present study. It has, however, been amended by using a head rest set at an angle of 25° to ease the patient's rather awkward position (Fig. 1). In order to obtain uniform pictures a quite simple appliance has been attached to this board to serve as a cephalometer. The main part is a face-bow with movable pointers which can be aimed at the poria and the orbital points. This face-bow slides up and down parallel to the board which also serves as cassette holder. Thus the pictures are oriented in the Frankfort horizontal plane. A fifth pointer can be moved up and down a slit in the rod which supports the face-bow. It has to be fixed against the nasal root and thus ensures sagittal orientation in the

Fig. 1
The cephalograms connected with this study have been made by Dr. S. Harris, radiologist, to whom the author is greatly indebted for his help and cooperation.

midline. The central ray is directed towards the middle of a line connecting the two poria. The distance between tube and cassette is 1.50m.

Originally small lead balls were incorporated into the plastic pointer tips. This device was intended to facilitate first orientation. It soon became clear that the film itself provided sufficient landmarks and, in order not to encumber the picture unnecessarily with extraneous features, this device was soon abandoned.

The Zygomatic Arch.

At first attentions were directed toward the appearance of the zygomatic arch in the basilar view, as the author has always been intrigued by the connection of the zygomatic arch with the masticatory system (Fig. 2). The importance of this relationship shall be stressed here once more by a short recapitulation of some investigations devoted to the subject. The relationship between zygomatic arch and teeth has been mentioned by Klaatch as early as 1909. Klaatch explained that generally the maxillary extension of the arch aims toward the mesiobuccal root of the first upper molar. In primitive people, however, this place is taken up by the distal root. Two years later Bluntschli described the relationship between the maxillozygomatic ridge and the dental arch during the period of growth. He found that the tooth most subjected to masticatory stress was always positioned below the ridge. Thus at the time of the deciduous dentition the second milk molar is to be found below the insertion of the ridge; a forward shift of the dentition brings the first molar into this place. These observations have been confirmed and their range extended by Broadbent in his study about the ontogenetic development of the occlusion. In a series of tracings the shift of the dentition in relation to the ridge can be beautifully followed from the age of one and one-half years when the first deciduous molar is below the ridge to the age of eighteen, when the first permanent molar finally occupies this place.

In the middle twenties Izard and the author simultaneously, but separately, showed that the bizygomatic arch width was numerically related to the alveolar width and could be used for diagnostic purposes. In a paper "Orthodontics as a Life Factor" (1941) At-

Fig. 2 Cephalogram in basilar view.

kinson once more called attention to the importance of the zygomatic arch. Referring to the connection between the alveolar - zygomatic ridge and the first molar on the one hand and to the importance of the molar as a key tooth on the other hand, he coined the expression "key ridge". At the same time he warned that "the mathematically minded orthodontists will find difficulty in using this landmark; it can never be said to be found so many millimeters from that point, nor can it be said normally to descend from the zygoma at an angle of a set number of degrees. Distances between points are constantly changing in growing skulls and, as skulls are individually of different shapes, various landmarks may not be said universally to be so many millimeters apart."

As the investigations by Izard and the author had at that time been published for some fifteen years, this remark might refer to the difficulties of using the key ridge in roentgenographic cephalometry. These difficulties consist in the fact that the ridge is not sharply defined, but is of rather vague shape and that in addition to this one gets — in the lateral view — two shadows, one for the ridge nearest to the film, the other for that on the far side.

The Point: "Buccale."

At first glance one gets the impression as if in the basilar view too the bizygomatic arch were not quite clearly defined. Especially in children where the arch is not yet fully developed it is overshadowed by the walls of the skull; particularly the determination of the most lateral points, used in the methods of both Izard and the author, would meet with difficulties. There is, however, an alternative to the most lateral point, the most forward one. It is situated where the interior surface of the arch turns medially and directly

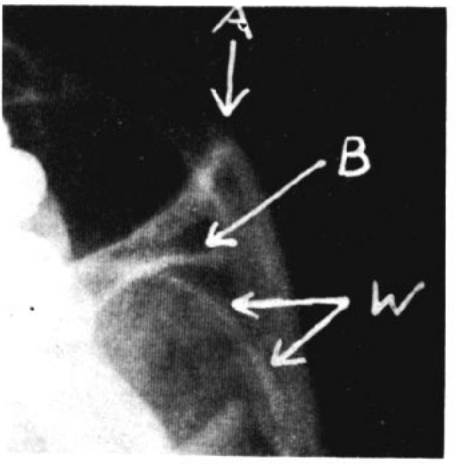

Fig. 3 Basilar view cephalogram of anterior zygomatic arch region with landmarks. A — Angulare, B — Buccale, W — Wing lines.

starts upon a backward sweep. This curve is well discerned in the basilar view, and it would be convenient to give a proper name to its most forwardly situated point. The term "Buccale" is proposed (Fig. 3). It is to be differentiated from other points connected with the zygomatic arch. "Jugale" is situated at the upper rim where this turns upward towards the orbita. "Zygion" is the most laterally protruding point of the zygomatic arch; it is this point which is used for the determination of the bizygomatic breadth. "Zygomaxillare" is called the lowest point of the maxillozygomatic suture; it does not show on the film. A point "Malare" has been introduced by Sassouni which is the "midpoint of the intersection between the projection of the coronoid process and the lower contour of the malar bone." It is used on the anteroposterior film.

If we connect the buccale points of both sides, we get a line which can be regarded as a cross section of a plane erected perpendicularly to the Frankfort horizontal plane, the "Buccale plane". The line can also be drawn as

a tangent to the curves representing the lower anterior rims. This method may be used to advantage when the curves do not show a sharp bend.

The importance of this plane lies in the fact that it cuts the alveolar arches in the region of the first molars. While measurable relationships between the zygomatic arches and these teeth were restricted to the width dimension, it will now become possible by using the same picture to study the relations in sagittal direction and to interrelate the results.

Until now investigations of this type had to use a lateral as well as frontal film to compare the results and recourse had to be made to perspective drawings. This laborious way, for instance, has been taken by Sassouni in his interesting study of the position of the upper first molar.

In this connection the findings of Potter and Meredith should be remembered, i.e., that sometimes measurements on the roentgen picture may give better results than those taken anthropometrically. While waiting for the accumulation of more material and its statistical evaluation, the author at present is inclined to believe that in the upper jaw the external alveolar width, where cut at a given time by the buccale plane, is approximately two-thirds of the width of this plane, i.e., the interbuccale distance.

The A, B, C Lines: Angulare, Buccale, Condyle Planes.

While the buccale plane seems to be a most promising landmark, there are, of course, others which may be useful. One of them is where, at the external orbital angle, the upper and lower rims of the orbita meet and together with the insertion of the zygomatic arch produce a dense area of triangular shape. The term "Angulare" is proposed for the tip of this density. A connection of angulare points of both sides would give a line which could be regarded as a cross section of an angulare plane. This plane cuts the dental arch in the cuspid-premolar region and will be a useful complement to the buccale plane connected with the molar region.

Backwards a tangent touching the distal contours of the condyles would give us a condyle plane which would facilitate the study of the position of the mandible in relation to the skull. The interrelation between these three planes should give us interesting information. For though all three planes belong essentially to the face, there is a difference between them in so far as the positions of the angulare and condyle planes are decisively influenced by the anterior and posterior parts of the cranial base respectively. It is the buccale plane only which is independent and which is particularly characteristic for the face because of the fact that an axis through the two buccale points would be nearer to the center of the face.

The Wing Lines.

By contrast there is a valuable landmark which belongs to the neurocranium entirely. It is easily recognized and always well defined: the outline of the anterior walls of the middle cerebral fossae. As these walls are mainly composed of the wings of the sphenoid bone, the name *wing lines* might be suitable. These lines together with the above discussed group should prove valuable when there is the question of investigating the relation between the visceral and neural parts of the skull under normal and abnormal conditions.

They may also be of special importance in longitudinal studies, in a way comparable to De Coster's base line. It seems very probable that the outline of these wings will show no change after seven or eight years of age

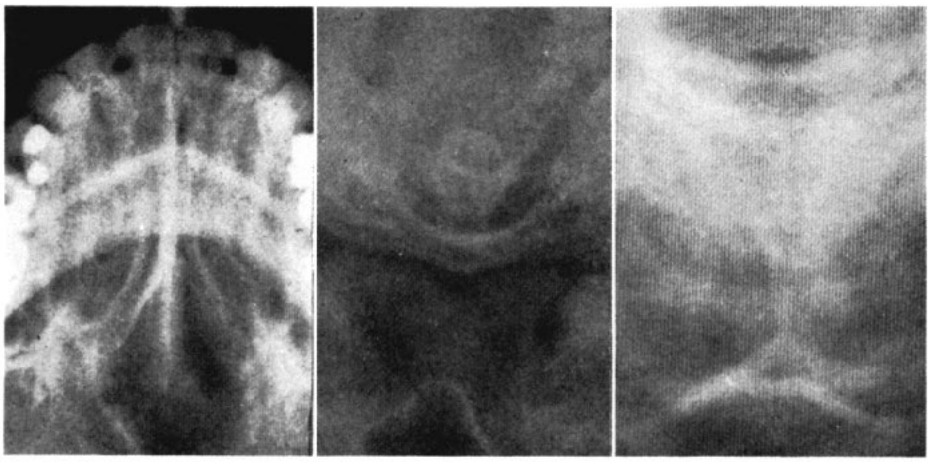

Fig. 4 Landmarks used for determination of sagittal midline. Left, Crista frontalis, crista galli and vomer. Center, Tubercle of atlas and odontoid process of epistropheus. Right, Crista occipitalis interior.

as is the case with the base line in the profile view. The author is supported in this assumption by the findings of Brodie about the stability of the cranial base, especially in this region.

Midlines.

Another and perhaps the most obvious use of a basilar film would, of course, be for the determination of a midline and the assessment of asymmetry. There are a number of points which qualify for this purpose: the anterior tubercle of the atlas, the odontoid process of the epistropheus and the outline made by the vomer and crista galli (Fig. 4). In addition to these, two characteristic features on the inner walls of the frontal as well as the occipital bone can help in the determination of the midline. These are the indentations in the outline of these bones caused by the crista frontalis and crista occipitalis interior respectively. As absolute symmetry in a skull scarcely exists, it will not be possible to draw a straight line through all these points. Some sort of interpolation is needed and, with the use of the above mentioned points, easily made.

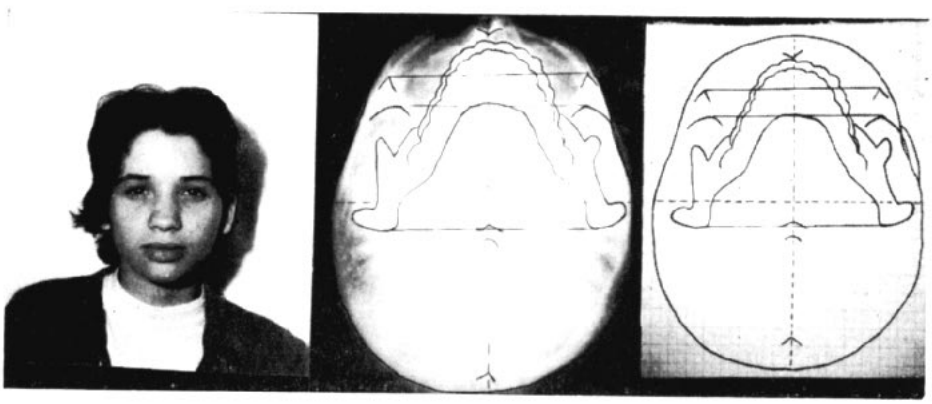

Fig. 5 Appraisal of asymmetry: face with marked asymmetry, cephalogram and tracing.

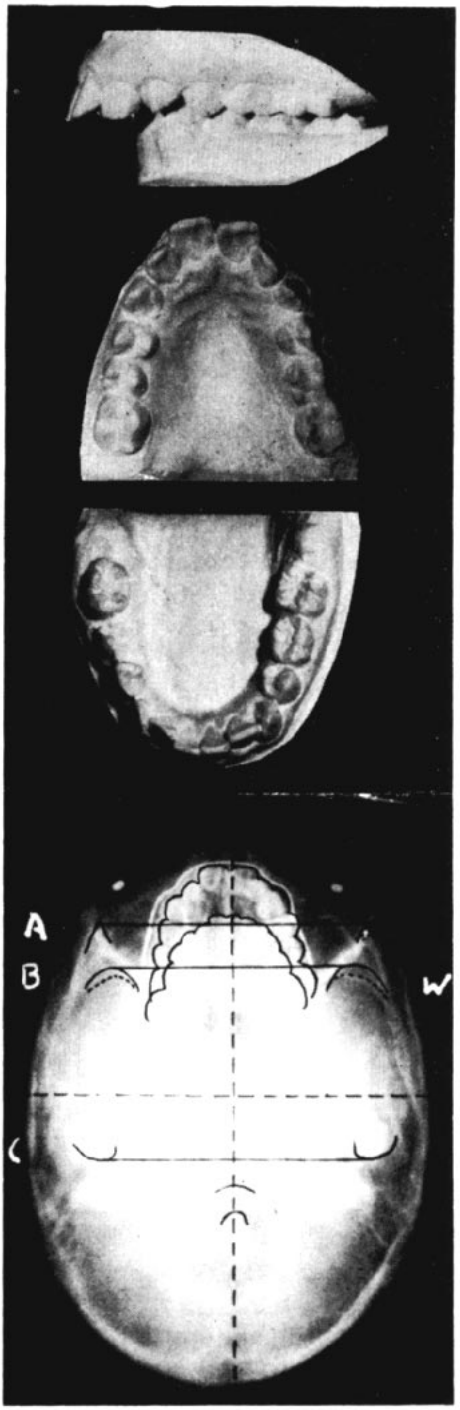

Fig. 6 Models and cephalogram of a boy with severe distoclusion; A, B, and C indicate the position of the angulare, buccale and condylar planes, W, the wing lines (dotted).

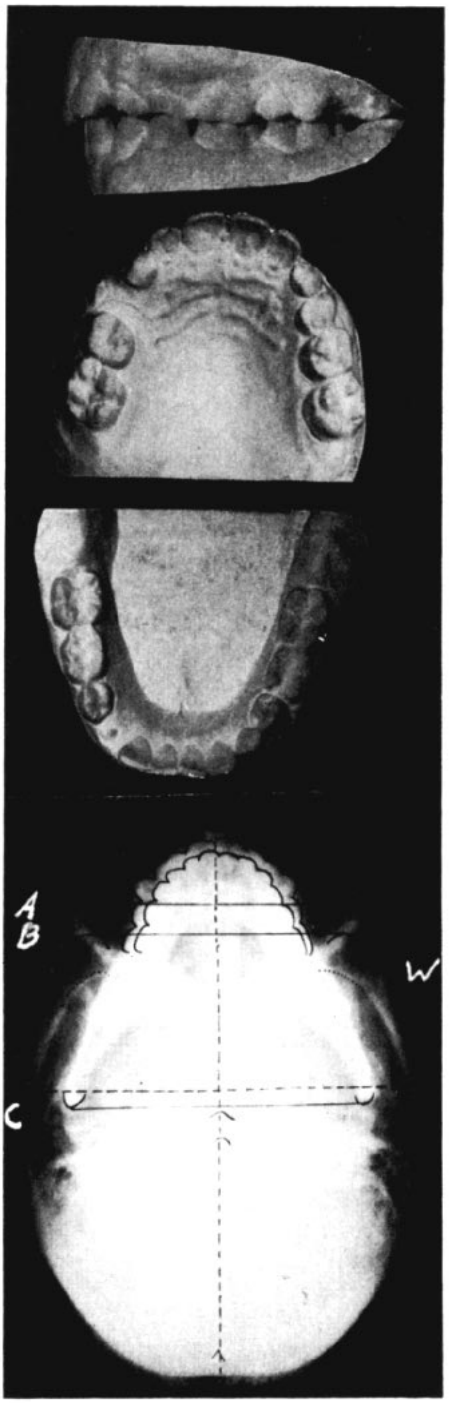

Fig. 7 Models and cephalogram of a boy with normal dentition.

For reference in the anteroposterior direction a transversal line through the sella had originally been envisaged in conformity with the prominence which this landmark enjoys in cephalometric roentgenology. But it soon became apparent in the course of the investigation that the outline of the sella and/or the end of the clivus were not always clearly definable, the variable formation of the sphenoid sinus interfering. As recent critical investigations by Baume have undermined the position of the sella anyway, this attempt was soon abandoned and a transversal midline through the center of the sagittal midline and perpendicular to it was introduced. This puts at our disposal a coordinate system which should be helpful in solving some of our problems (Fig. 5).

Analysis of Distoclusion.

In this context only one recurring question should be mentioned: the relative importance of the upper or lower jaw respectively in the etiology of distoclusion.

Figures 6 and 7 show models and cephalograms of two boys of approximately the same age. It will easily be seen that in both cases the upper first molars have almost the same relationship to the buccale plane. The angulare plane, too, cuts the upper alveolar arches in the same region. On the other hand we find that the condyle plane in the normal case is practically coincident with the transversal midline, while in the distoclusion case it is about one-sixth of the head length behind the transversal midline, i.e., about one inch towards the back. On the basis of these findings we should come to the conclusion that in this case distoclusion is caused by, or at least connected with, an extreme backward position of the glenoid fossae, while the upper arch is normally placed with respect to the angulare and buccale planes.

Teeth and Dental Arches.

Finally the fact should be stressed that individual teeth can be more easily identified here than in the lateral view, where the teeth of the two sides cannot be distinguished, while in the frontal view they are projected over each other anteroposteriorly. We can simplify our task still more by placing some separating wires at the upper and/or lower molars, or we can even delay taking the picture until some distinguishing parts of the appliance have been fixed (Fig. 6).

In cases where we are interested in the upper jaw only, as for instance in the studies of the upper first molar, we can get still clearer pictures if they are taken with the mouth open. Another possibility is to have the patient open the mouth during the exposure. Then the shadow of the mandible is eliminated. One gets, of course, a slightly blurred picture, but this disadvantage is more than compensated by an unrestricted view of the upper jaw which in cleft palate cases is quite important. Not only the position and extent of the cleft is seen clearly, but also the existence of unerupted and/or supernumerary teeth is easily diagnosed (Fig. 8).

The appearance of the dental pattern in basilar cephalograms should be useful too when used for identification purposes. In addition to the plenitude of sagittal and transversal diameters, this pattern together with the outlines of head and mandible could be used in a final analysis.

Conclusion

At the end of this paper which is in the nature of a provisional report, the author expressly wants to state that in spite of the fact that certain lines could be represented as A, B, C lines, he is

Fig. 8 Basilar view cephalogram of a cleft palate: Left, mouth closed; Right, mouth being opened during exposure.

far from the idea that by this the ABC of basilar cephalometry has been evolved. This is just a beginning. As indicated in the title certain problems of this method and its promises have been discussed. If only part of the endeavour and ingenuity devoted up to now to the lateral view is transferred to the basilar view, some of the problems should be solved and some of the promises realized in not too long a time.

69, Rothschild Blvd.

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