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Some Observations on a Careful Photographic Technic

BRUCE A. CURRAN, D.D.S.

Cleveland

THE field of clinical photography, in my opinion, lends itself to many interesting phases of our work. In many respects it is a very exacting science. Clinical photography in Orthodontia would not have made the progress it has without the fine work of Simon, Lischer, McCoy, Ketcham and others. Simon in particular has gone to great lengths to describe a very exacting photographic technic.

It is the purpose of this paper to give you my concept of the limitations, as well as the possibilities, involved in photography for the orthodontist. I believe that photographs should be regarded entirely upon their esthetic value, which will be in proportion to the care used in their making. I will describe the technic used in my office, if for no other reason than that you will be better able to appraise the material presented to you. It is *not* given as a method which I regard as beyond improvement, but in view of what is now known about change in the face during developmental growth, I believe it is a good and practical technic. I do not even claim originality for all of it, although many phases of it resulted from my own reasoning.

The number of photographs taken of each patient before and after treatment may vary with *existing* conditions, but the usual procedure in my office now consists of taking *profile, front* and *occlusion* photographs, such as shown in Fig. 1.

The scale used for the profile and front photographs is one-fourth, while that for the occlusion photograph is full size. The camera used is a Zeiss Maximar which is equipped with an adaptable ground glass for focusing and an adaptable film holder which accommodates 12 (9x12 c.m.-$3\frac{1}{2}$x$4\frac{3}{4}$ inch) films. The lens has a focal length of 13.5 c.m. ($5\frac{5}{16}$"); the speed varies from 1/200 of a second to 1 second and more for time exposures. Double extension bellows permit use at close range. The film used is Eastman's Verichrome. Northeast, *natural* light is used. The time of exposure varies from about 3 to 10 seconds at F22 or 32. The background consists of a cream grey shade held by the assistant or hung on the wall in back of the subject.

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The landmarks on the face, as shown in Fig. 2, are used in focusing in the ground glass so that the head will be oriented to the camera in a definite way. In the profile photograph one arrow points to the deepest wrinkle in the skin under the lower left eye, and the other arrow points to the top of the left ear hole. A plane passing through these two points will be referred to as the eye-ear plane. In the front-face photograph the arrows point to these same landmarks below the eyes in the skin. Note that no reference is made to the Frankfort Plane. It is my opinion that because the landmarks locating this plane are bony landmarks, namely, lowest point on the lower border of left orbit and highest point on inner surface of left external auditory meatus, they can be located accurately *only* on a skull or X-ray record.

Fig. 1.—Case No. Ag 21 shows the one-fourth scale front, profile, and full scale occlusion photographs. (See also Figure 11.)

There are two terms which should be made clear so that technical description may not become confusing. They are *lens axis* and *field of critical focus.* As seen in Fig. 3, the lens axis is illustrated by the dotted line which passes through the center of the lens perpendicular to the center of the camera back or film surface. The field of critical focus is illustrated by the dotted line which passes through the mid-line of the head. Note that it is perpendicular to the lens axis and parallel with the camera back or film surface. The field of critical focus is evidenced on the ground glass of a camera when a sharp image of the subject appears and the lens is properly adjusted to the ground glass. Also in Fig. 3 is shown the orientation of the head to the camera for obtaining the profile photograph seen at the left. Note that the head position is such that the eye-ear plane is parallel to the base or floor.

In the center of the figure are shown the front view of the subject and the side view of the camera showing the lens axis from the center of the lens to a level just below the eyes. Immediately below this the top view of the head of the subject and camera are evident, showing the lens axis from the

Fig. 2.—Arrows point to landmarks on the face which are used in focusing in the ground glass.

center of the lens to the left eye point. The field of critical focus is in the mid-line of the head, which is necessary to obtain a sharp profile. It should be noted that the 27 inches refers to the distance from the lens to the mid-line or field of critical focus. This distance is used only with this type of camera when the lens is properly adjusted or related to the film surface in order that a one-quarter size image of the subject will result.

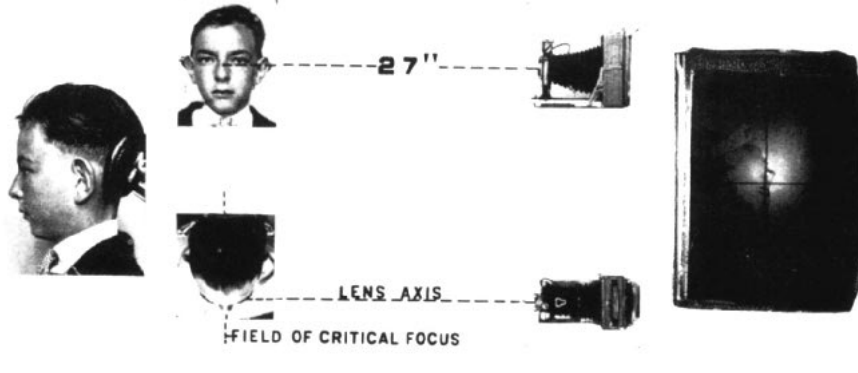

Fig. 3.—At the left the profile photograph is shown. In the center, the orientation of head to camera. At the right, the image in the ground glass.

To more clearly illustrate how this profile photograph is obtained, the subject is seen focused in the ground glass at the right in Fig. 3. To those familiar with the use of a ground glass for focusing, this is not confusing insofar as the image is always inverted. The horizontal and perpendicular lines are pencil markings on the ground glass, which divide its length and width respectively. The intersection of these lines marks the center of the ground glass and determines for us the lens axis referred to previously.

Thus, in this view of the profile, the head is oriented in such a manner that the horizontal line in the ground glass is in the eye-ear plane. The perpendicular line intersects the horizontal line, marking the lens axis immediately above the eye.

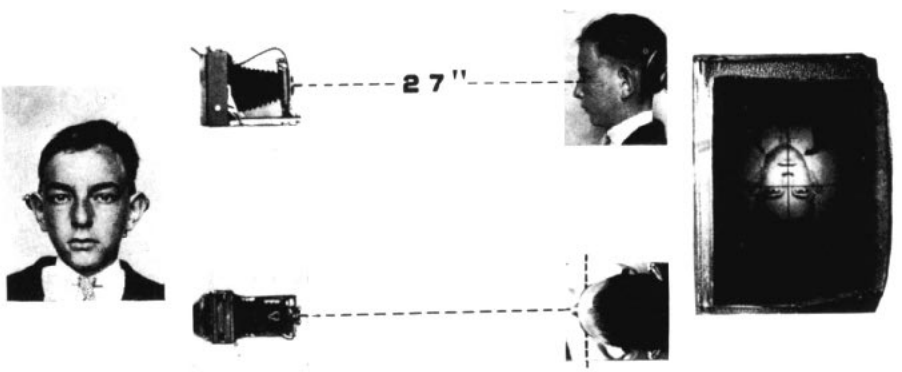

Fig. 4.—At the left, the front photograph is shown. In the center, the orientation of the head to the camera. At the right, the image in the ground glass.

In Fig. 4 is shown the orientation of the head to the camera for obtaining the second, or front photograph, seen at the left. The head of the subject has not been disturbed from its previous position as the dental chair has been rotated 90 degrees to obtain this exposure.

In the center of the illustration are seen the side views of both the head and camera showing the lens axis from the lens to the eye point. Note that the lens axis, if continued, would be in the eye-ear plane. The top views of both head and camera are evident, showing the lens axis from the lens to the tip of the nose and in the mid-plane of the head, if continued. The field of critical focus, or the perpendicular line, is in the plane of both eye points.

To clarify this, as was done in the profile description, we see at the right in Fig. 4 the front face focused in the ground glass. The perpendicular line is in the mid-line of the head while the horizontal line passes just above the eyes on the wrinkles previously mentioned. The intersection marks the lens axis on the bridge of the nose. Before the third or occlusion photograph is described let us consider the method used to orient the head and camera in the office.

In Fig. 5 are shown the dental chair and the camera, which has been adjusted for $\frac{1}{4}$ size reproductions, placed upon the Angle-Wuerpel table. The chair is positioned for the profile photograph and is oriented to the floor covering, which has a square design, by means of the straight edge on the foot rest

seen at the lower right. The table is on a track which controls its relative position to the same lines in the square design. Thus, by means of the floor covering, the chair and table are oriented to each other. The table top and camera both have straight and right-angled sides which can easily be oriented to each other. Thus the camera can be properly oriented to the chair, and as previously explained, the subject's head is correctly oriented by means of focusing in the ground glass and is supported by the head rest.

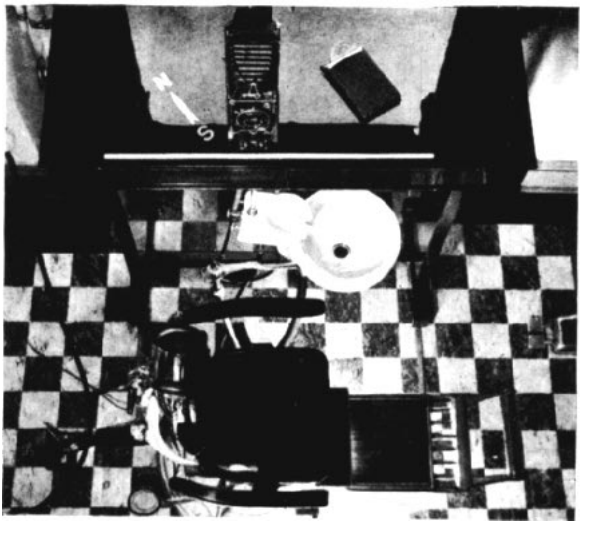

Fig. 5.—This illustration shows how the camera, table and chair are orientated to each other by means of the square design in the floor covering.

The reflection in the table top is that of the window which affords access to northeast natural light, as is evident by the N & S arrow or compass direction.* The white stick in front of the camera is 27 inches long and is used to measure the distance from the lens to the field of critical focus after the face has been focused in the ground glass. The film in the film pack adapter is also on the table top available for replacing the ground glass adapter after focusing.

For the front photograph the chair is rotated ninety degrees and re-oriented to the table by means of the floor design and the front of the foot rest. It is well to emphasize here that the patient should be seated in the chair so

*A suggestion relative to lighting was made by Mr. Edmund H. Wuerpel, formerly Director of Arts, the Department of Fine Arts, Washington University, St. Louis, Missouri. His criticism while made privately was of such a constructive nature that the author believes it should be included here for the reader's benefit. Mr. Wuerpel pointed out the difficulty of interpretation of photographs taken with natural light on different dates. This is due to the variability of the intensity and properties of sunlight. The contours of the face such as cheeks, lips, nose and ears are recorded by various shades between white and black. Artificial light can be controlled or standardized making those contours appear comparable, while with natural light, because of its variability, the contours may appear more or less pronounced in one set of photographs than in the other. The artist's comment has a very practical bearing upon our problems and is much appreciated.

that the head is in the eye-ear position as comfortably and firmly as possible. In my office the patient is not disturbed from this position while the profile and front pictures are being taken. The only instruction given the patient is to keep the posterior teeth together.

In Fig. 6 is shown the orientation of the head to the camera for the occlusion photograph seen at the left in the illustration. This involves three operations which vary from the profile and front photo-technic. The subject's head must be tilted back so the plane of occlusion is parallel with the base or floor; the bellows of the camera is completely extended for the full-size image which is to be obtained, and the lip retractors are placed for tissue exposure.

Note in the center of the figure that we work at a closer distance, 10.5 inches, and that the lens axis, as shown by the dotted line, is in the plane which is continuous with the plane of occlusion. Although not shown here, the field of critical focus should include the upper lateral incisors. At the right, in Fig. 6, is also shown the ground glass illustration. The horizontal line shows that the plane of occlusion is correctly oriented and the perpendicular line indicates that the mesial contacts of the central incisors are correctly oriented. Thus the intersection of these lines indicates that the lens axis is correct.

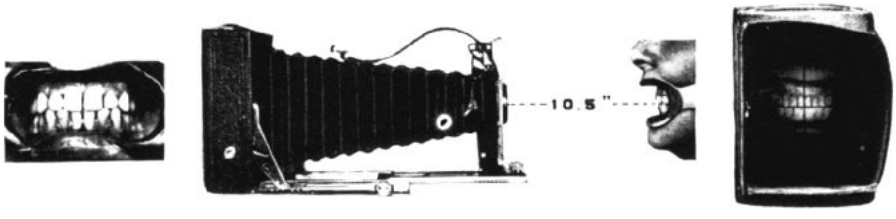

Fig. 6.—At the left, the occlusion photograph is shown. In the center the orientation of head to camera. At the right, the image in the ground glass.

The Advantages of a Definite Technic

The following figures are intended to illustrate the advantages of a definite photographic technic, and in the study the original negatives and prints were enlarged four times to eliminate errors which smaller material endangers.

Fig. 7 shows three profile views of a subject to illustrate the different results obtained when the head and camera vary only slightly from the technic just described. The black dot in each photograph represents the direction of the lens axis. The profile on the left was taken according to the technic. The one in the middle was taken after the camera had been moved sideways, keeping mid-plane of head and film surface parallel, so that the lens axis was directed at the tragus. The one on the right was taken after the subject had been lowered in the chair so that the lens axis was directed above the ear. The difference between the latter two mentioned and the one on the left is clearly seen in the superimposed tracings below the photos. The solid line tracing in each one is that of the standard taken from the left photograph. The broken line tracings are those taken from the respective photographs above and superimposed on the standard tracing on the eye outline. In the middle tracings the broken line profile and ear are both more closely related to the eye than in the

standard tracing. In the right tracing the broken line profile and ear are not only closer to the eye, but the nose, lips, and chin are different from the standard tracing. Bear in mind that the *distance* of camera to subject was *not* changed in these but the relative position of camera to head *was* changed.

The purpose of Fig. 8 is to show the reason for selecting the plane of both eyes for critical focusing in front photograph, and the point below the eye for the direction of the lens axis in the profile exposure. On the left is shown the face photographs taken as described in the technic. Below are seen the tracings of these. Note the broken lines which join lip line and under-surface chin outlines. Below are seen small diagrams indicating head and camera orientation, field of critical focus and lens axis. On the right are seen the photographs and tracings of the same lad taken on the same day but with a different

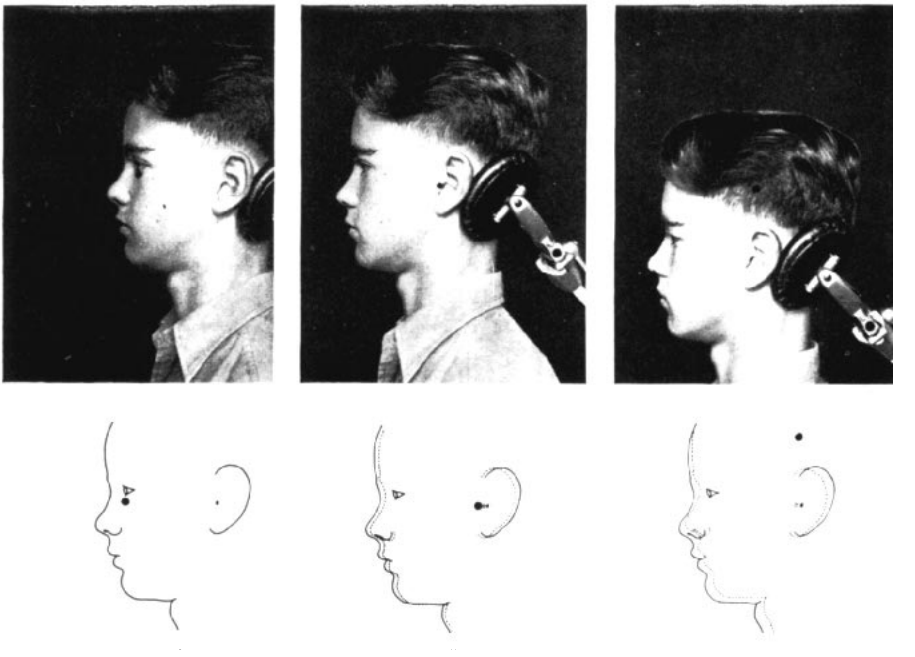

Fig. 7.—These profile photographs and tracings show the actual difference resulting when the relative positions of head and camera are altered only slightly without changing the distance between the two. The lens axis is indicated by the black dot.

orientation of head and camera. For the front picture, as seen in the diagrammatic sketches below, a plane through ear holes was used for the field of critical focus. For the profile picture, the top of the left ear hole was used for the direction of the lens axis. Note that the broken lines extending from the lip line and under-surface chin in the profile record fall *above* the corresponding points on the front face record. This is because in the front face exposure the lips, chin and the entire front of the face were between the field of critical focus and the lens and are consequently distorted or enlarged, whereas these same landmarks are in the field of critical focus in the profile exposure.

The thing to be observed here is that in *both* the front and profile photo-

graphs, as shown on the left, we record the front part of the face and that, in so doing, they are more instructive for comparative observations.

The following material is of particular interest to me in view of never having seen similar evidence in the literature which I used as reference.

The purpose intended in Fig. 9 is to see what degree of dependability is obtained with a photographic technic. At the left are the front and profile views of the subject used. At the right are composites of five front face and five profile tracings of photographic records taken non-consecutively. In other words, five different sets of pictures (front and profile) were taken of the sub-

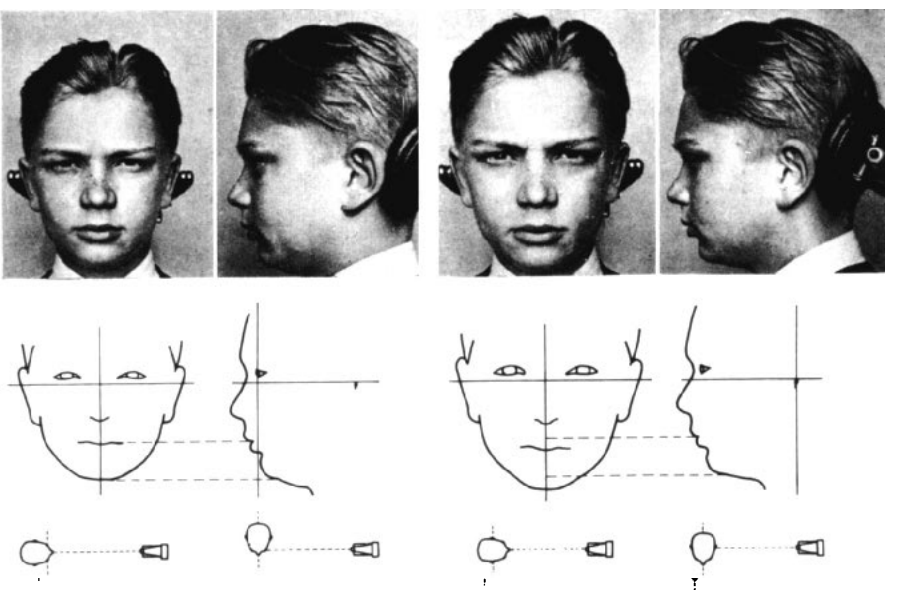

Fig. 8 shows in the tracings of the two sets of photographs the reason for selecting the eye-eye plane for critical focus in making the front photograph and the eye point as the direction of the lens axis in the profile photograph. Head and camera position are clearly shown at the bottom of the tracings.

ject on the same day, and between each set he was out of, and then reseated in, the dental chair and reoriented to the camera. I regard the results as fair, but the fact that there is any difference at all makes it obvious to me that without a rigid head holder and a firm base for the camera two or more pairs of pictures cannot be taken without some error.

An effort is made in Fig. 10 to show the amount of distortion resulting with this technic. *Before* the photographs were taken, five small black triangular bits of mucilage paper were placed on the face and various face measurements were recorded. The black spots may not be in evidence on the photographs because of reducing for printing, but their exact locations are recorded on the tracings at A, B, C, D, and E (front) and B, D, and E (profile). Z is the approximate location of zygomatic arch. The numbers represent in millimeters those measurements taken directly from the enlarged photograph (above the line in each pair) and those taken directly from the subject's face

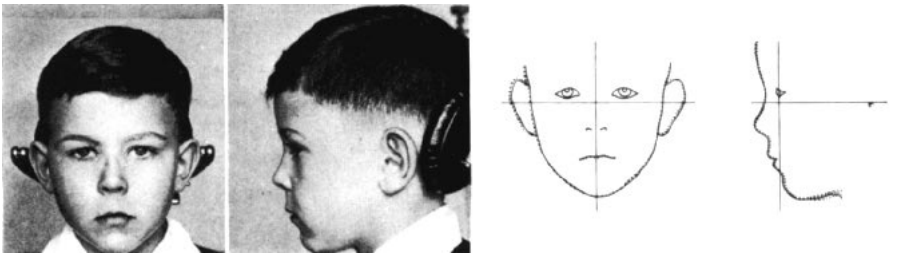

Fig. 9.—The subject used and the tracings, superimposed on eyes, to show how "close-to-perfect" duplication resulted in five (5) non-consecutive exposures with this technic.

(below the line in each pair). The results are interesting and instructive, clearly showing the amount of distortion in front of and in back of the field of critical focus. The interpupillary measurements are both 54 m.m. and this is because the eyes are *in* the field of critical focus, and the reproduction should be accurate. The A B measurements differ by only 1 m.m., the measurement taken from the photograph being greater. This is because the points A and B were between the lens and the field of critical focus (eyes), or in front of it, and consequently enlarged in reproducing. (Note relative position of B to eye in profile tracing). The bizygomatic and C D measurements taken from the photograph are both less than those taken from the face because the landmarks measured were farther from the lens than the field of critical focus (eyes) or in back of the latter. Their reproduction is therefore diminished from actual size. (Note relative positions of D and Z to eye in profile tracings.)

These results emphasize the hazards involved in attempting to take accurate measurements from photographs, especially those records made at a comparatively close distance of camera and subject.

In Fig. 11 (numbered 1, 2, 3, and 4) are shown the enlarged profile photographs of case Ag 21 treated from 1-36 to 9-37 and tracings made from them (broken line—*before* active treatment; solid line—*after* active treatment). In number 3 the superposition is on the eye pupil and eye-ear plane. In number 4 the superposition is on the ear hole and the eye-ear plane. I think that you

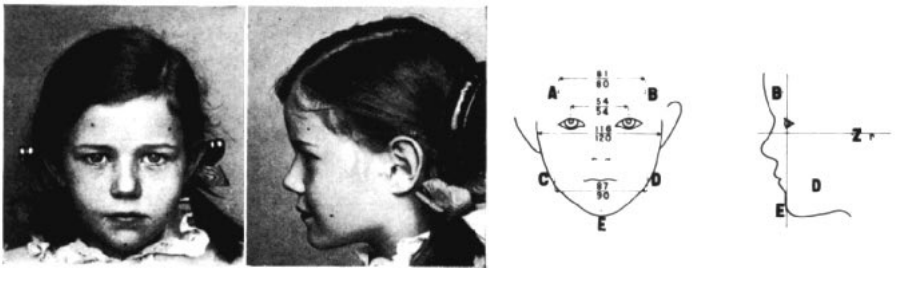

Fig. 10.—The enlarged photographs of the subject used and tracings to show amount of distortion. Points A, B, C, D, and E=black spots placed on face before photographs were made. Z=approximate location of zygomatic arch. Numbers=millimeters taken from photograph (upper) and taken from face (lower).

will agree that these two superpositions look slightly different, number 4 inferring that there exists more "change" as the result of facial adjustment during treatment. I use the word *inferring* because by these superpositions, using a horizontal (eye-ear) plane and eye and ear as guides, I show a record of a certain number of millimeters of change in the face. Certainly a change in the face has taken place, but I do not believe that this method, or any method where planes are used on photographs, is scientific or logical for the following reason:

The work of Broadbent in the "Bolton Study of the Development of the Face of the Growing Child" has shown by x-ray records made with his exacting technic that during normal and abnormal developmental growth of the face the ear hole (Porion) moves downward, backward and laterally from a

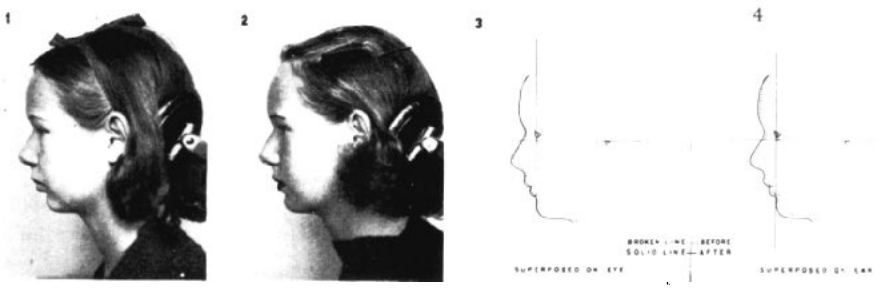

Fig. 11.—1. Case Ag 21, also shown in Fig. 1, before active treatment (1-11-36). 2. After active treatment (9-14-37). 3. Tracing of *before* and *after* superposed on eye. 4. Same tracings superposed on ear. Note the different profile changes inferred in 3 and 4. Neither one is accurate because the ear and eyes are *not* stable landmarks from which to measure change.

more stable area in the mid-plane of the head between the eye and ear. More specifically, he measures from the Bolton registration point in the body of the sphenoid bone. This change of ear position, *if* recorded in these photographic tracings, would entirely change both the horizontal and perpendicular lines here shown, as well as the profile outlines.

Without access to exacting x-ray records of this case which would enable us to correlate the bony changes of the face to the soft tissue changes, I do not believe such super-positions are accurate, because an accuracy is inferred which is not true in the light of the latest findings on growth and development of the face.

I might add in this regard that in the not-far-distant future announcement will come through the proper sources which will make precision x-ray equipment for office use available to all of us. The progressive orthodontist will not be without it. I believe that photographs have no substitute as a record for comparing the *appearance* of the face before and after treatment and that care in the technic of their making should be stressed.

Conclusions

1. Photographic case records have an esthetic value for which there is no substitute.

2. The value of photographic case records is in direct proportion to the care with which they are made.

3. A definite technic should be used to orient head and camera in making at least two (front face and profile) photographic records before and after treatment so *comparative appearances* can be observed.

4. The technic critically described herein is regarded by the author as practical, considering space and equipment required and results obtained.

5. Lines or planes on photographs are misleading because they do not possess the accuracy which is inferred by them; namely to record developmental growth changes in the face. Such changes can only be recorded by means of an exacting head x-ray technic.

I wish to express my sincerest gratitude to my wife, Helen Curran, Miss Thomas, Librarian at W. R. U. Dental School, Miss Hubert, my assistant, Mr. L. P. Martinek, and Mr. Philip Slater of the Eastman Company, Dr. Paul Aufderheide, and, as usual, Dr. B. Holly Broadbent, whose counsel, friendship and inspiration I have always cherished.

1024 Rose Building.

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