The Frankfort-Mandibular Incisor Angle (FMIA) In Orthodontic Diagnosis, Treatment Planning and Prognosis*

CHARLES H. TWEED, D.D.S.
Tucson, Arizona

For as long as I have been teaching advanced orthodontics under the auspices of the Foundation, I have been plagued with this sixty-four dollar question most often asked by the younger men — "We endeavor to follow the mechanics of treatment you have taught us, but for some reason facial esthetics in our practices are not as good as those you obtain. Why?" My answer has been — "Perhaps, due to lack of experience you have not attained my appreciation of balance and harmony of facial outline for that comes only with years of experience." Admittedly, this has not been a very satisfactory answer to the query.

In the hope that a better understanding of cephalometrics might be an aid in the solving of my problem I completed a short course in cephalometrics given at the University of Washington in Seattle. Our instructors were Drs. A. Moore, W. Wylie, W. Downs and R. Riedel. Needless to say, with such instructors the course was an excellent one for beginners.

I returned home disappointed in that I had learned nothing that helped me answer the familiar old question asked by my students. "Why are facial esthetics in my practice inferior to those in yours even though I use the mechanics you teach?"

I reflected that cephalometrics had been available to the profession for approximately twenty-two years and that such men as Broadbent, Margolis, Brodie, Wylie, Downs, Moore, Higley, Thompson, Riedel and many others seemed to have focused their attention on what changes occurred during growth and the changes the orthodontist has made as a result of his treatment. Not enough thought, perhaps, had been focused on how cephalometrics might be applied in diagnosis and treatment for the every-day clinical orthdontist. Be reminded, that for every research man studying growth with his cephalometer there must a hundred clinical orthodontists each patiently awaiting some cephalometric technique that will benefit routine diagnosis and treatment prolems. He is more interested in information that can be applied to better his treatment than finding out what he has done after treatment, when it is a bit too late.

These were some of the thoughts in my mind when I returned home. This prompted me to select four treated cases (Figs. 1-2-3-4) in which I thought facial esthetics were pleasing. The normal inclinations of the mandibular incisors had been of interest to me for twenty years. The variations found in the FM angle and the effects on facial esthetics when that angle was overly large, have also been of great interest to me for the past ten years. This gave me the impulse to draw a triangle in white ink on the head film. For the Frank-

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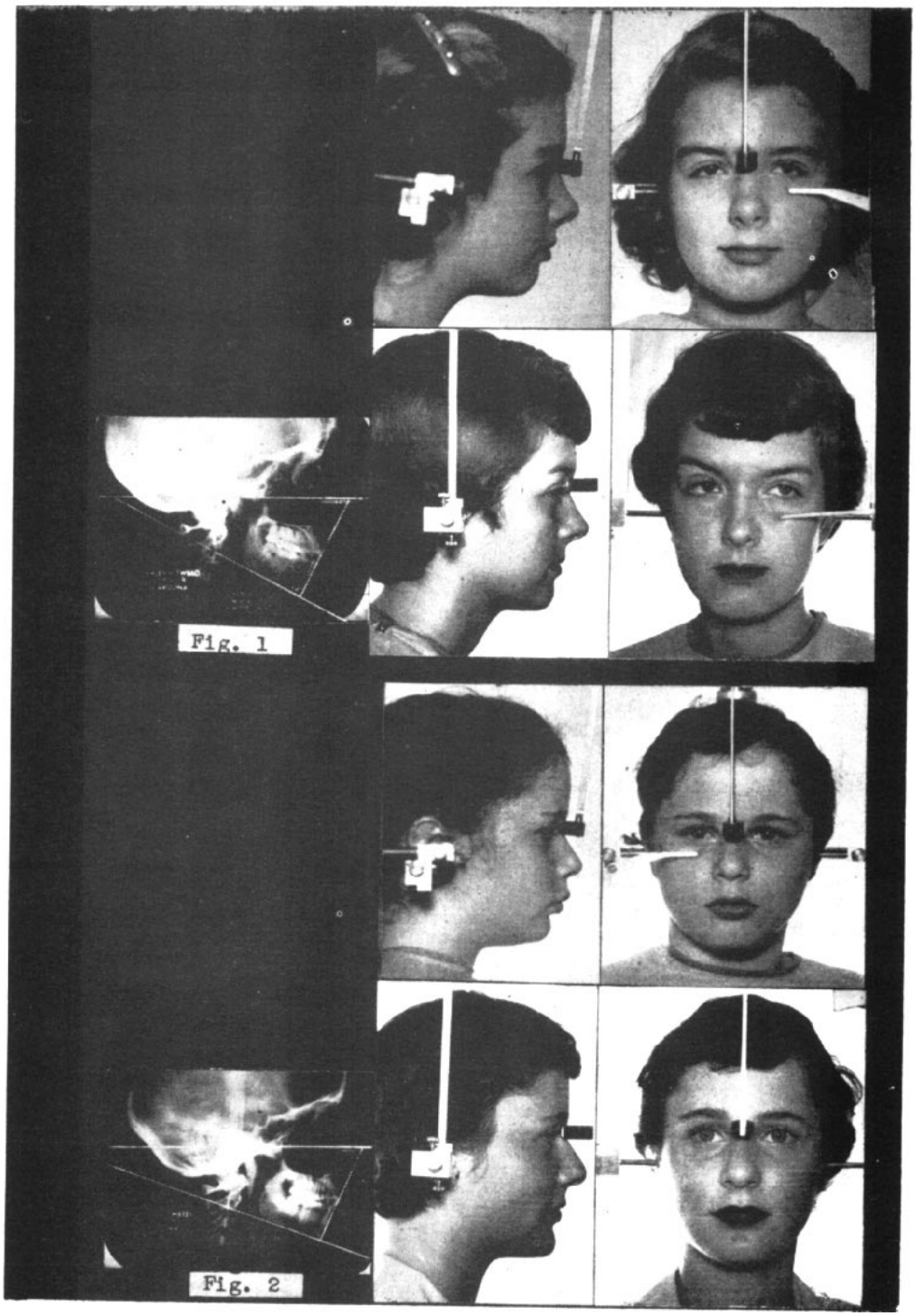


Figs. 1, 2, 3 & 4. Four treated cases showing pleasing facial values.

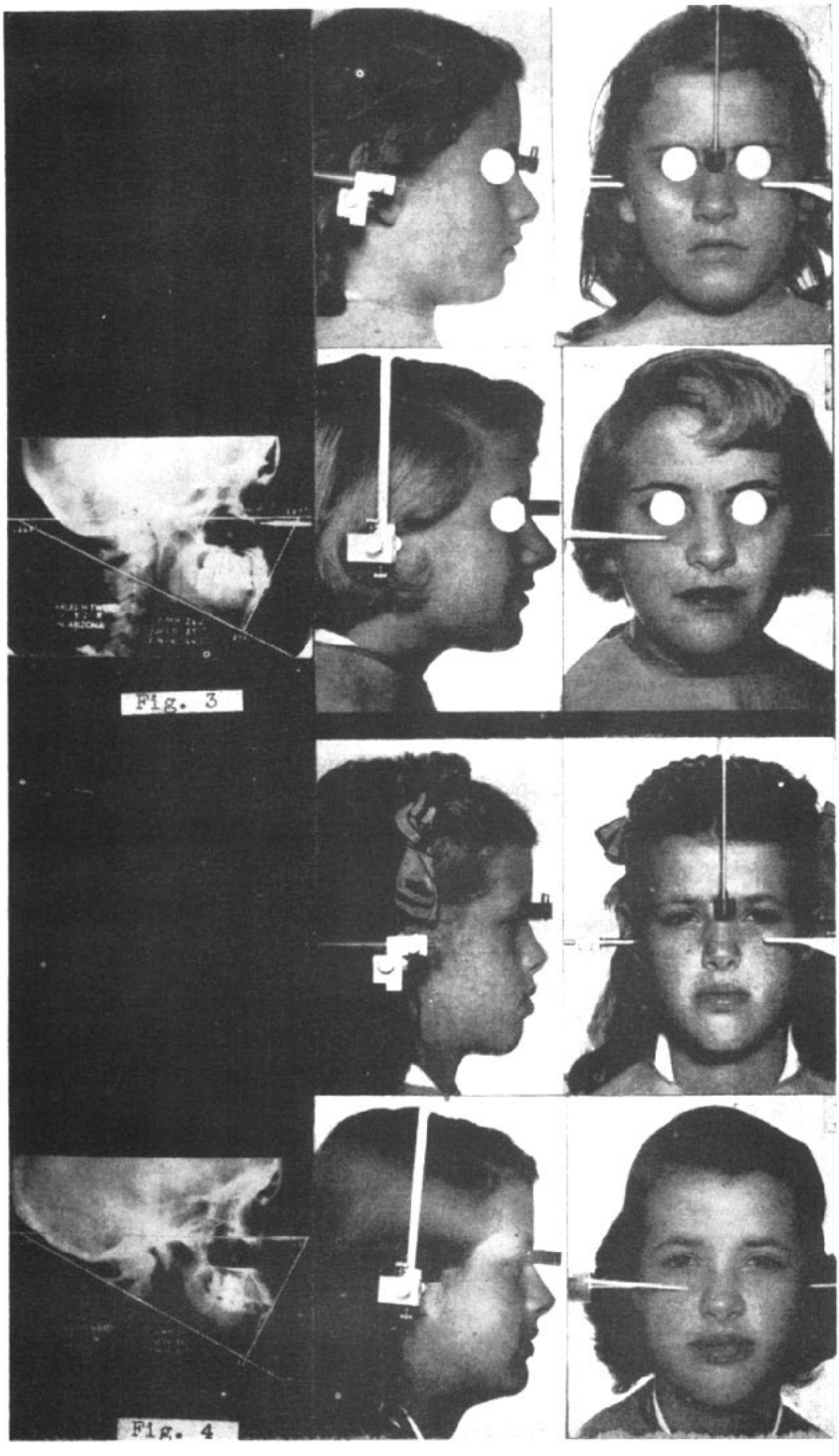


Fig. 3

Fig. 4

fort plane I connected a point 4½ mm above geometric center of the ear rod with the lower border of the orbit.

The mandibular plane connecting Frankfort plane was drawn in the accepted manner. The *incisor-mandibular plane angle* (IMPA) was constructed by drawing a line through the apex and incisal edge of the mandibular central incisor, extending it to intercept the Frankfort and mandibular planes thus forming the triangle.

The angles were measured and I noted that the *Frankfort-mandibular incisor angles* (FMIA) were 65°, 66°, 64.5° and 65°: all very close to 65 degrees. (Figs. 1-2-3-4.)

For many years I have considered that the normal variation in the *Frankfort-mandibular angle* (FMA) ranges between 20° and 30°. Midway between 20° and 30° would be 25°, which I arbitrarily have called the norm for that angle. Also for many years I have considered the normal variation of the inclinations of the mandibular incisors, when related to the plane formed by the lower border of the mandible, to range from 85° to 95° with 90° being designated the norm. Therefore, if one accepts an FMA of 25° as the norm and a 90° inclination of the mandibular incisors when related to the lower border of the mandibular as a norm, the norm for the third angle, FMIA, automatically becomes 65°.

Perhaps these figures that I use as norms are not as accurate as they might be, since the work done by Downs, Brodie and others at the University of Illinois give the norm FMA average as 21.9° and the IMPA norm as 91.4°. Accepting their figures as norms rather than mine, that for FMIA would become approximately 66.7° rather than the 65° minimum requirement as advocated in this paper.

Having noted an FMI angulation of approximately 65° on these four patients previously treated, with very satisfactory facial esthetics, I decided to select a group of samples picked entirely from the standpoint of satisfactory facial esthetics. It is impossible to find many samples that satisfy in every detail one's idea of perfect balance and harmony of facial outline. Therefore, it was decided to be somewhat elastic and select individuals who had good balance of facial outline rather than ideal. These samples were selected in the following manner. When the opportunity afforded itself and a face was observed that I thought had pleasing balance of facial outline, whether it be at the Kiwanis Club, the Old Pueblo Club, a friend of a friend, a mother or father of a patient, and so forth, the name was placed on a list and the prospective sample persuaded to have photographs and head plates made. *No attempt was made to examine the malocclusion if one existed.* A few of these samples were taken from my older treated cases, none of whom had previously been examined cephalometrically. A large majority of the samples was taken from non-orthodontic cases selected as outlined above. When once the name appeared on the list the figures were used, regardless of how disappointing they might be to me after examining the headplates.

After I had secured forty-five samples and had measured the angles I found the following averages: the FMA averaged 24.9°; the incisal inclination when related to the lower border of the mandible was 86.6° and the FMIA (the angle formed by the long axis of the mandibular incisor with the Frankfort plane) was found to be 68.6°. These findings indicate that my minimum requirement of an FMIA of 65° is not harsh and that the dividing point between extraction and non-extraction, an FMI angle of 62°, is quite liberal.

The findings of these 45 samples in-

dicated that 25° as a norm for FMA, 90° as the norm for incisal inclinations and 65° for the FMIA norm were workable figures.

To date, I have some ninety-five samples and plan to select a minimum of one hundred before the project is completed. There is but slight difference in the average of the angles of the ninety-five as compared with the first forty-five samples. (Figs. 1 to 4, 5 to 37). The averages for the ninety-five samples are: FMA 24.57, IMPA 86.93 and FMIA 68.2.

From experiences of the past two years, I am of the opinion that the norms used by Downs warrant further investigation, particularly the normal inclinations of the mandibular incisors (IMPA) which he gives as 91.4°. The same applies to the norm of 90° previously advocated by Tweed.

My reasons for such a statement are as follows.

One. Fig. 38 is taken from the August, 1940, issue of the American Journal of Orthodontics and Oral Surgery, "Some Recent Observations on the Growth of the Face and Their Implications to the Orthodontist", by Brodie. This report embraced the records of twenty-one normal children who were selected at random on the basis of excellence of roentgenograms. Eleven were in the three-month to seven-year range and ten in the six-month to eight-year range. Each series of roentgenograms consisted of fourteen sets of headplates taken quarterly during the first year of life, semiannually from one to five years, and annually from then on. All were males. In nine of these cases only the crowns were traced and not the roots, so the incisor mandibular plane angle could not be measured. In the other eleven instances the incisor mandibular plane angles are as follows: in one case the angle is 92 degrees: in six cases the angle is 90 degrees; in one case the angle is 84 degrees; in one case the angle is 87 degrees; in one case the angle is 85 degrees; in one case the angle is 83.5 degrees.

The angular variation of the mandibular incisors with relation to the lower border of the mandible is 8.5° in this group of normals. The average for these eleven cases is an incisor mandibular plane angle of 88.3°.

Two. In the Angle Orthodontist, October, 1941, page 239, Fig. 11, in B. Holly Broadbent's paper, "Ontogenic Development of Occlusion," there appears an illustration summarizing the study of normal dentofacial developmental growth from the Bolton Study records of 3,500 white Cleveland children. (Fig. 39)

This illustration reveals the following facts:

1. The composite representing the children in the 3½ year bracket shows the incisor mandibular plane angle to be 88.5°.

2. The composite representing the children in the 7-year bracket shows the incisor mandibular plane angle to be 83°.

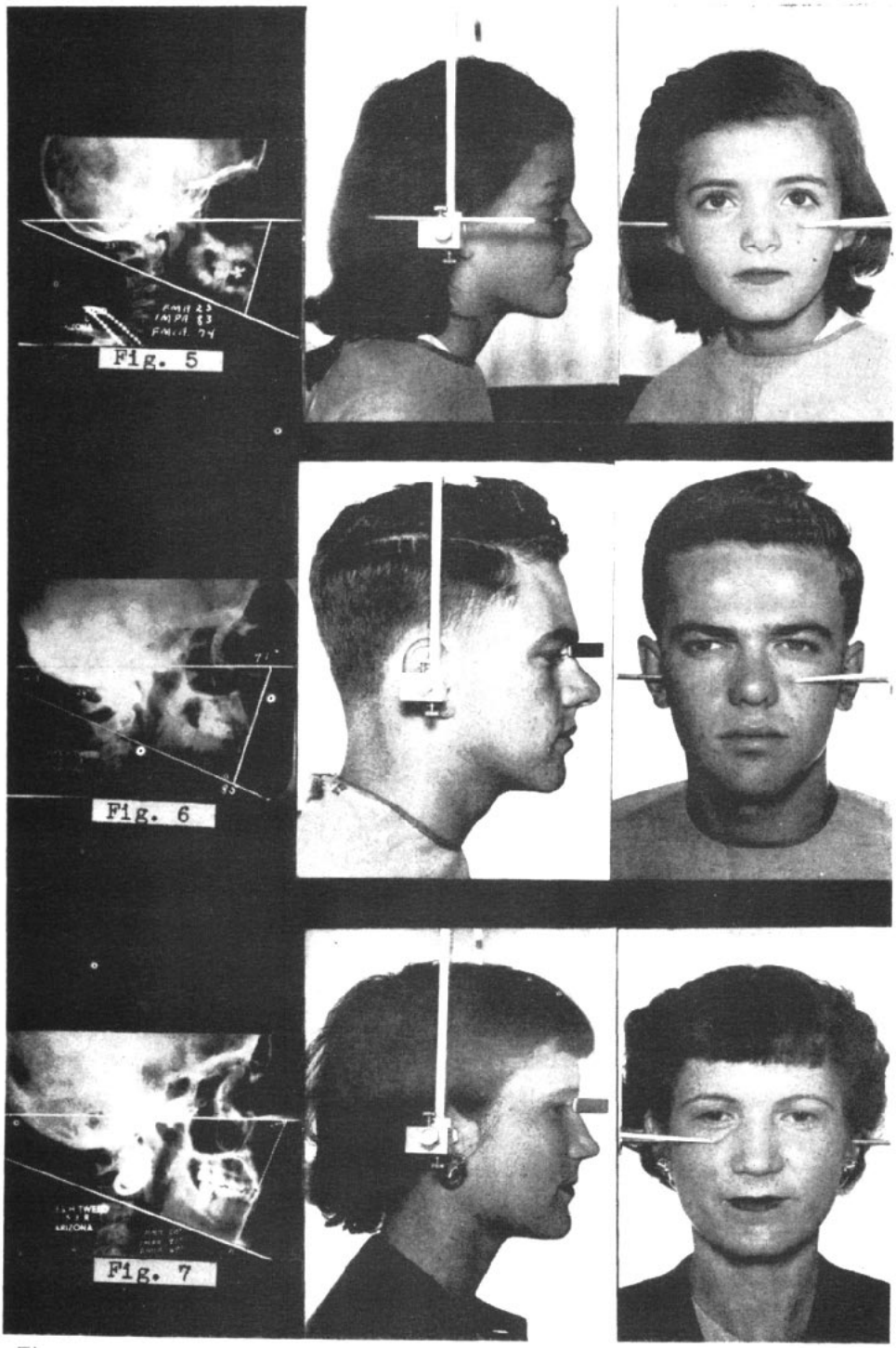
3. The composite representing the children in the 14-year bracket (the ones we are most interested in) shows the incisor mandibular plane angle to be 89.5°.

4. The composite representing the adults shows the incisor mandibular plane angle to be 92.5°.

The average for these 3,500 cases is an incisor mandibular plane angle of 88.4°, which is within 0.10° of the average for the normals reported by Brodie.

Three. The thirty-seven samples illustrated in Figures 1 to 4, 5 to 37, selected by me on the basis of good facial esthetics, present an average incisor mandibular plane angle (IMPA) of 86.55°.

The average in the individuals de-



Figs. 5 to 37. Individuals selected for their good facial balance from whose profile roentgenograms the FMA, IMPA and FMIA values were derived and averaged.

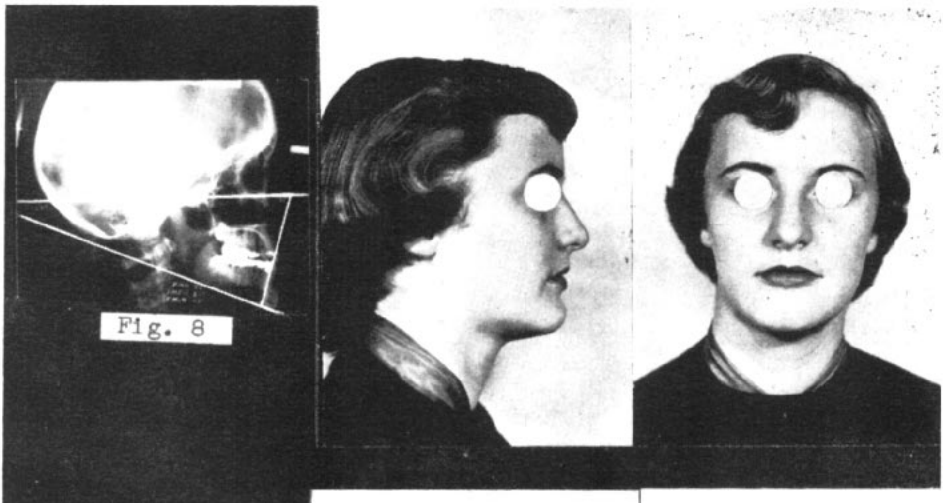


Fig. 8

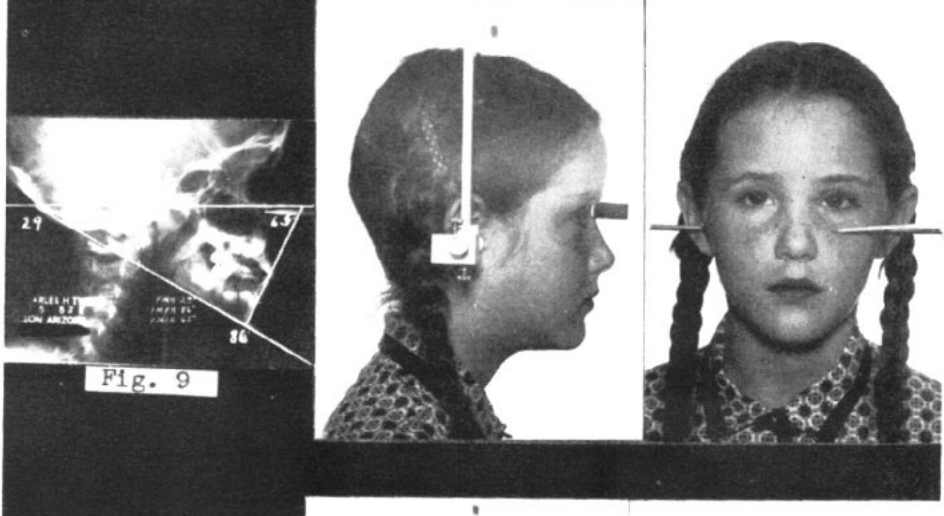


Fig. 9

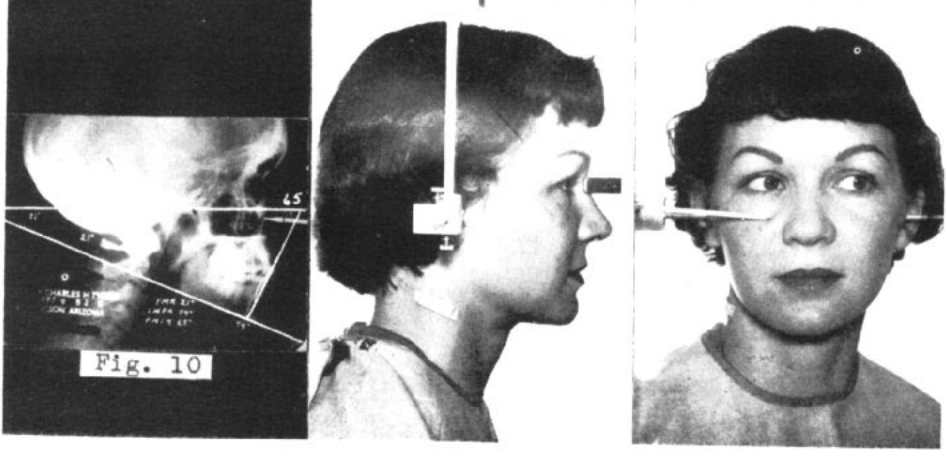


Fig. 10

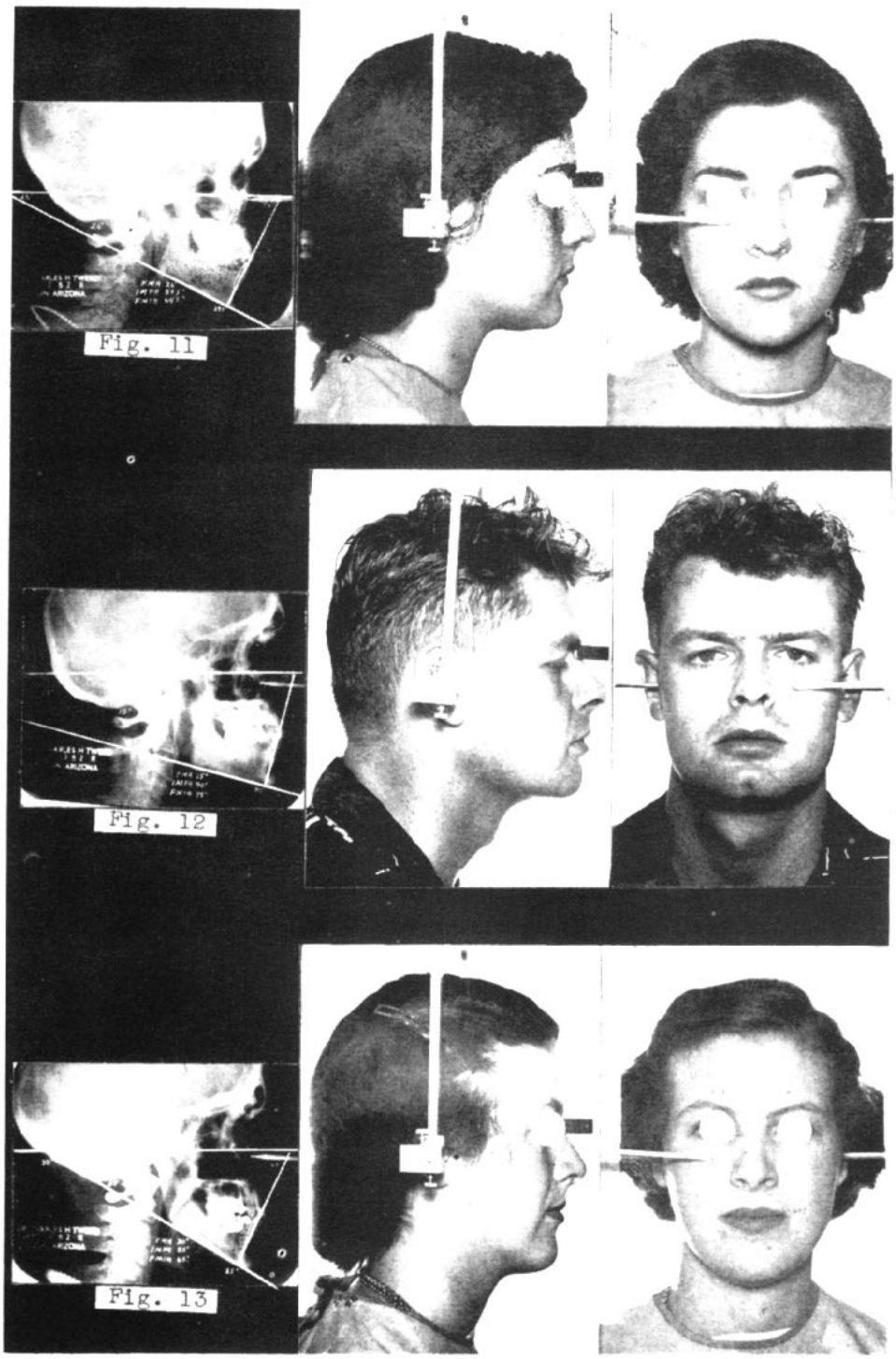


Fig. 11

Fig. 12

Fig. 13

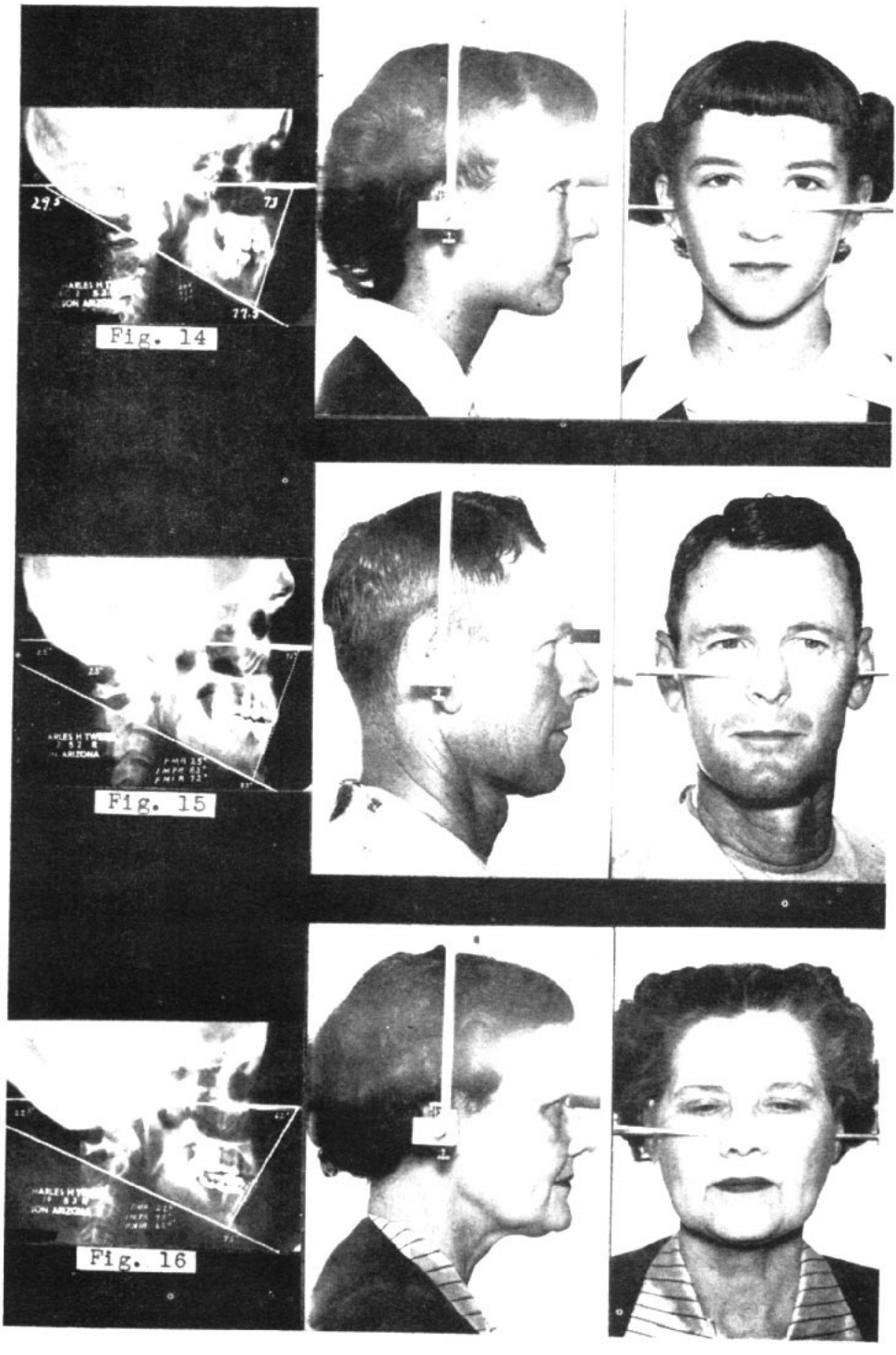


Fig. 14

Fig. 15

Fig. 16

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Fig. 19

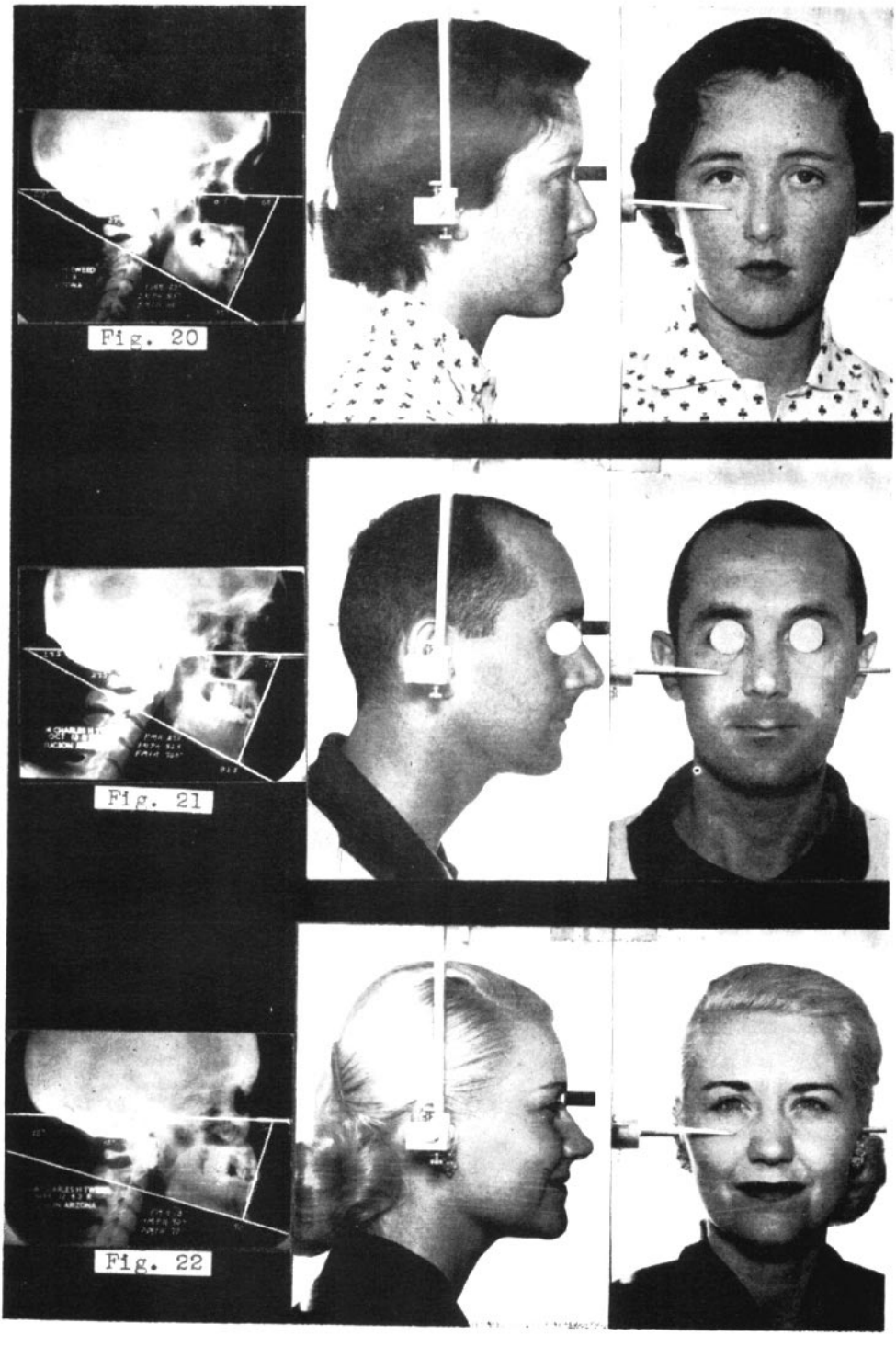

Fig. 20

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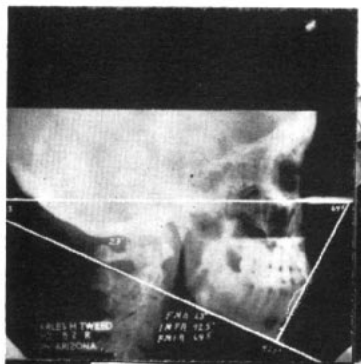

Fig. 29

Fig. 30

Fig. 31

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Fig. 33

Fig. 34

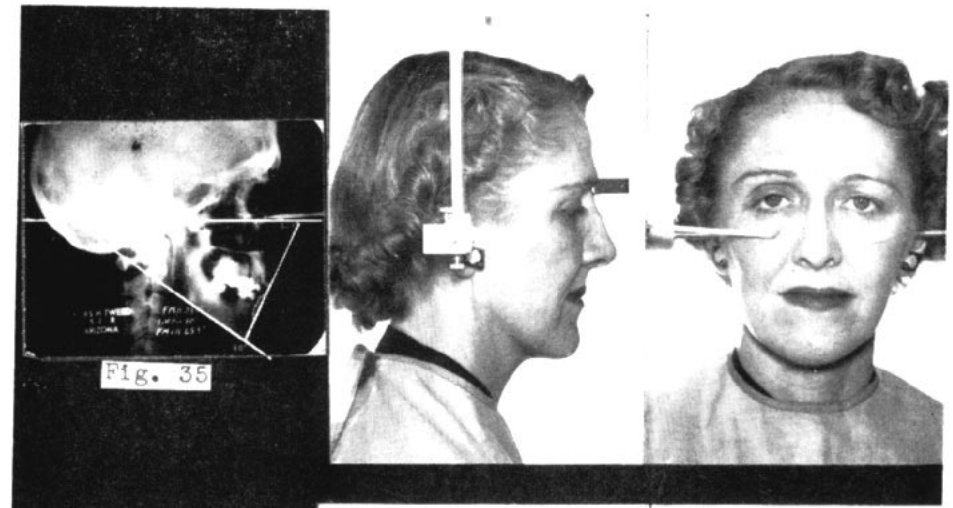


Fig. 35

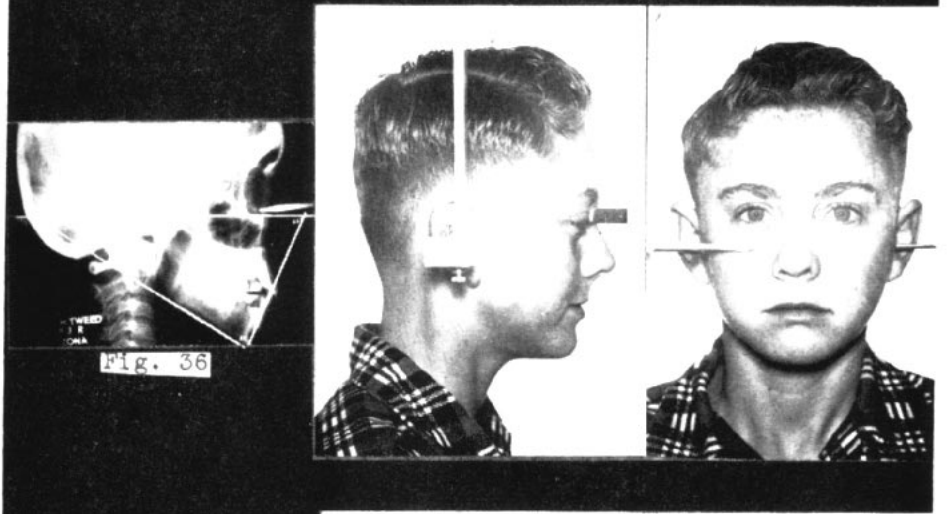


Fig. 36

Fig. 37

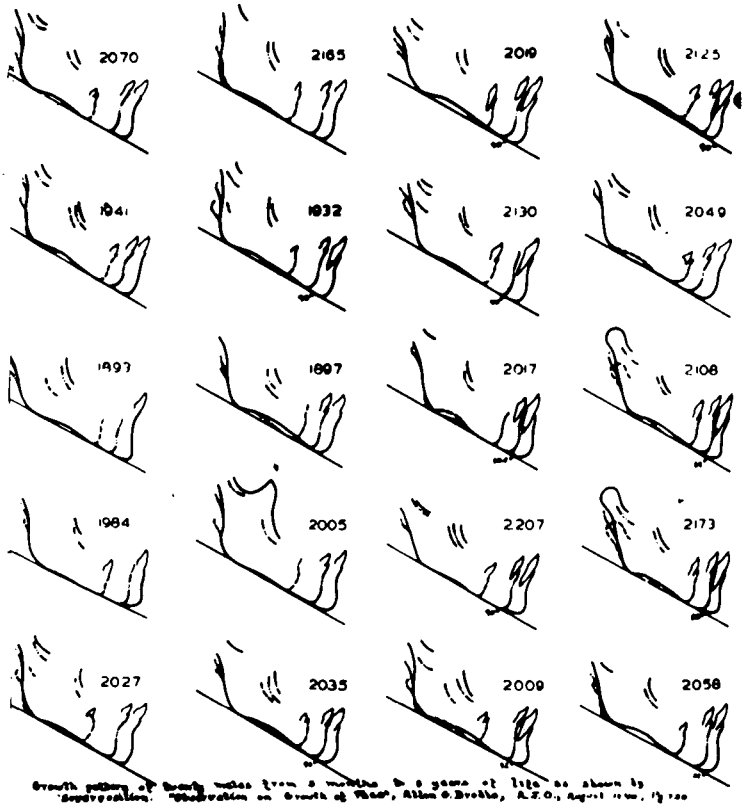
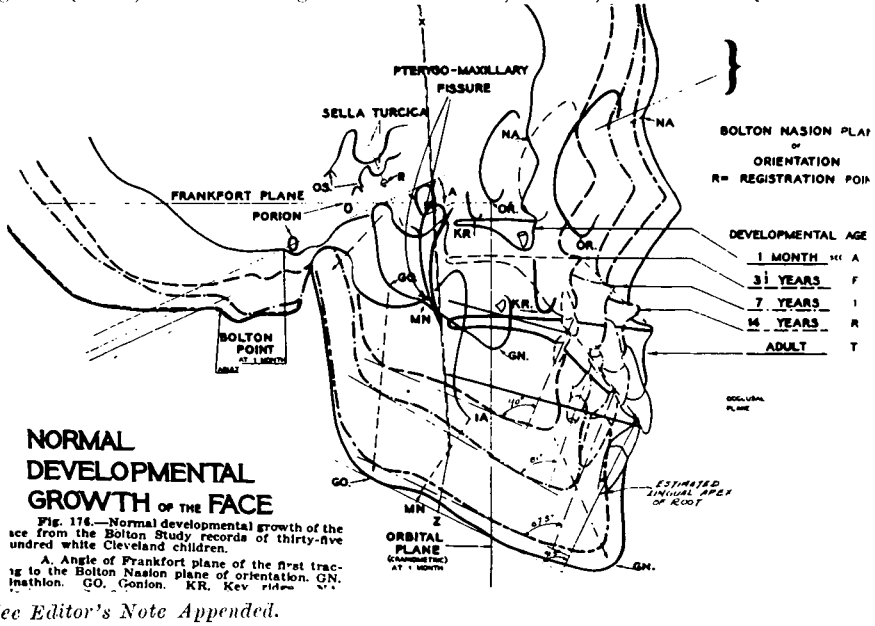


Fig. 38. (above) Courtesy American Jour. Orthodontics and Oral Surgery: 26, 740-757, 1940: Allan G. Brodie.

Fig. 39. (below) From The Angle Orthodontist: 11, 223-241, 1841: B. Holly Broadbent.*



*See Editor's Note Appended.

scribed by Brodie and Broadbent as normals and in Tweed's ninety-five samples selected on the basis of good facial esthetics, is an incisor mandibular plane angle (IMPA) of 87.88° which is 3.52° less than the average of 91.4° used by Down's in his analysis. (Chart 1)

Furthermore, the thirty-seven samples illustrated in this paper as examples of good facial esthetics present an average Frankfort mandibular angle (FMA) of 24.913 as against the Downs average of 21.9° for this angle. Let me also call your attention to the fact that the point I use for Frankfort, 4.5 millimeters above geometric center of the ear rod, would tend to make the angle smaller rather than larger. Therefore, my convictions are that the acceptance of 24° for FMA, 87° for IMPA and 69° for FMIA as norms, will result in more ideally proportioned facial esthetics and give more stable end results. (Chart 1)

CHART I

RANGE AND GROUPING OF FMA, IMPA AND FMIA IN 95 SAMPLES PRESENTING GOOD FACIAL ESTHETICS

FMA Range (15° to 36°)	No.	IMPA Range (76° to 99°)	No.	FMIA Range (56° to 80°)	No.
15	5	76	1	56	1
16	0	77	2	57	0
17	4	78	1	58	0
18	1	79	2	59	0
19	3	80	3	60	0
20	7	81	7	61	1
21	4	82	4	62	2
22	5	83	8	63	3
23	9	84	8	64	6
24	5	85	10	65	17
25	5	86	5	66	8
26	11	87	1	67	10
27	7	88	5	68	4
28	7	89	2	69	10
29	5	90	6	70	7
30	2	91	8	71	6
31	1	92	6	72	3
32	6	93	3	73	3
33	4	94	3	74	2
34	1	95	4	75	9
35	2	96	1	76	0
36	1	97	2	77	1
		98	1	78	0
		99	2	79	0
				80	2
TOTAL	95		95		95
AVERAGE	24.57°		86.93°		68.20°

The foregoing research suggested that I apply this formula to the treatment of my patients. An FMIA of 65° was to be considered the minimum requirement. Whenever it became necessary to exceed an FMIA of 62°, extraction was deemed necessary. I present the following thirty-seven consecutively treated cases, Figs. 40 to 76. The following figures are the averages of the three angles after treatment: — FMA 27.54°, IMPA 86.5°, and FMIA 67.01°. In addition, Figs. 77 to 82, with tracings superimposed on S-N, are the last six cases retained in my office applying the formula. (Chart 2)

In my opinion, the change in facial esthetics has been dramatic in approximately 30% of these treated cases; in the past, these dramatic changes did not occur more often than in 10% of my cases. In virtually all instances where conditions would allow me to attain the minimum requirement of 65° for FMIA, facial changes both in Class I and Class II cases, whether extraction or non-extraction, were dramatic. Where I was unable to fulfill this requirement for reasons, at times, beyond my control, facial esthetics were not as pleasing and disharmony seemed to be in proportion to the degrees I failed to approach an FMIA of 65°.

A few words to those, who like myself, have been visually estimating the inclinations of the mandibular incisors for varying FM angles of our patients, might now be in order. Let me say that visual estimation is most inaccurate as compared with measurements taken from the lateral head x-ray. I have found my visual error of ascertaining the FM angulation to be from zero to as much as 11 degrees. It is true that in perhaps 60% of cases I can guess this angle within two or three degrees, but in the remaining 40% of cases the error has been from 3° up to 11°. This inaccuracy must be eliminated if better treatment procedures are to be expected. Likewise, when visual methods have been depended upon, I have erred in the correct inclinations of the mandibular incisors when related to the lower border of the mandible as much as 10°. This being true, at least in my case, one is very liable to miss the correct FMIA by as much as ten degrees if visual methods rather than the headplates are utilized. My advice therefore, is that every clinical orthodontist will be a better orthodontist if he is guided by the cold facts demonstrated by a lateral head plate rather than by his eye.

There are those of us who use the phrase, "compensating the inclination of the mandibular incisors for varying FM angles." The meaning of the phrase is that for each degree the patient's FMA exceeds the norm of 25° the mandibular incisors must be positioned a corresponding number of degrees posterior to their accepted 90° norm. They accept 25° as the norm for FMA and 90° as the norm for the inclination of the mandibular incisors when related to the lower border of the mandible. Example — A patient presents an FMA of 35°. Thirty-five degrees is ten degrees larger than the norm of 25°. Therefore, the correct inclinations of the mandibular incisors in this patient is 80°, or 10° less than the norm of 90°. No one can consistently place the incisors in their correct inclinations without the aid of a lateral head x-ray.

The method I am teaching these students in quest of better facial esthetics in their orthodontic practices is as follows:

Fig. 68-a. A lateral head plate is made of the patient and the triangle is drawn on the head plate with white ink. A dotted line starting at the apex of the mandibular incisor is drawn upward to intercept the Frankfort plane

CHART 2.

Before and after angular values of thirty-seven consecutively treated patients.

FIG.	FMA	IMPA	FMIA	ANB	*EXT.
40	26	101	53	0.5	yes
	25	79	76	—0.5	
41	20	88	72	5	yes
	22	88	70	5	
42	24	100	56	6	yes
	19	91	70	4	
43	26.5	95.5	58	6	yes
	24	90	66	3.25	
44					yes
	27	89	64		
45	21	107.5	51.5	4	yes
	19	91.5	69.5	4.5	
46	35	90	55	5.25	yes
	35	87	58	4.75	
47	33	100	47	6.5	yes
	19	89	62	3	
48	24	101	55	4.25	yes
	24.5	92	63.5	2.75	
49	27	87	66	4	yes
	27	84	69	3	
50	35.5	86	58.5	3	yes
	35	82.5	62.5	2	
51	26	95	59	6	yes
	26.5	89	64.5	4	
52	32.5	96	51.5	3	yes
	33	76.5	70.5	2.5	
53	30.5	91	58.5	5	yes
	28	78	74	3.25	
54	26	94	60	4	yes
	26	77	77	0	
55	29	96	55	4	no
	30	87.5	62.5	1.5	
56	26	88	66	1	no
	27.5	80	72.5	—0.75	
57	19	100	59	6.75	no
	20	96.5	63.5	2.5	
58	26	95	59	3	no
	26	89	65	2.5	
59	33	94	53	7	yes
	33	101	46	4	
60	29	92.5	58.5	4	no
	28	83	69	2.75	
61	22	93	65	3.5	yes
	24	86	70	1.5	
62	33	97	50	6.5	yes
	30	89	61	5.5	
63	32.5	85.5	62	6	yes
	36	69	75	3.5	
64	30	94	56	6	yes
	27	86	67	3	
65	30	96	54	7.25	yes
	29	87	64	3.25	
66	26.5	94.5	59	3.5	no
	27.5	83	69.5	3.25	
67	30.5	103.5	46	10	yes
	30	84	66	5.75	
68	28	103	49	1	no
	27	84	69	—1.5	
69	32	90	58	1.25	yes
	32.5	71	76.5	0.75	
70	21	101	58	6	no
	22.5	90	67.5	2.5	
71	19	104	57	6.25	yes
	19	99	62	3.5	
72	23	94	62	5	no
	23.5	92.5	64	2.5	
73	32	82.5	65.5	4	yes
	36.5	77.5	66	1.75	
74	30	92	58	0	yes
	31	73.5	75.5	1	
75	30	90	60	6.75	no
	30	86	64	4	
76	26	101	53	7.75	yes
	24	89	67	3.50	
77	20	98.5	61.5	3.5	yes
	18	79	83	0	
78	33.5	82.5	64	4	yes
	34	75	71	2.75	
79	24	104	52	6	yes
	21.5	94	64.5	3.75	
80	34.5	94	51.5	4.75	yes
	34.5	78	67.5	0	
81	30	96	54	5	yes
	32.5	76.5	71	2.5	
82	24	100	56	8	yes
	24	93.5	62.5	2.75	

* Extraction

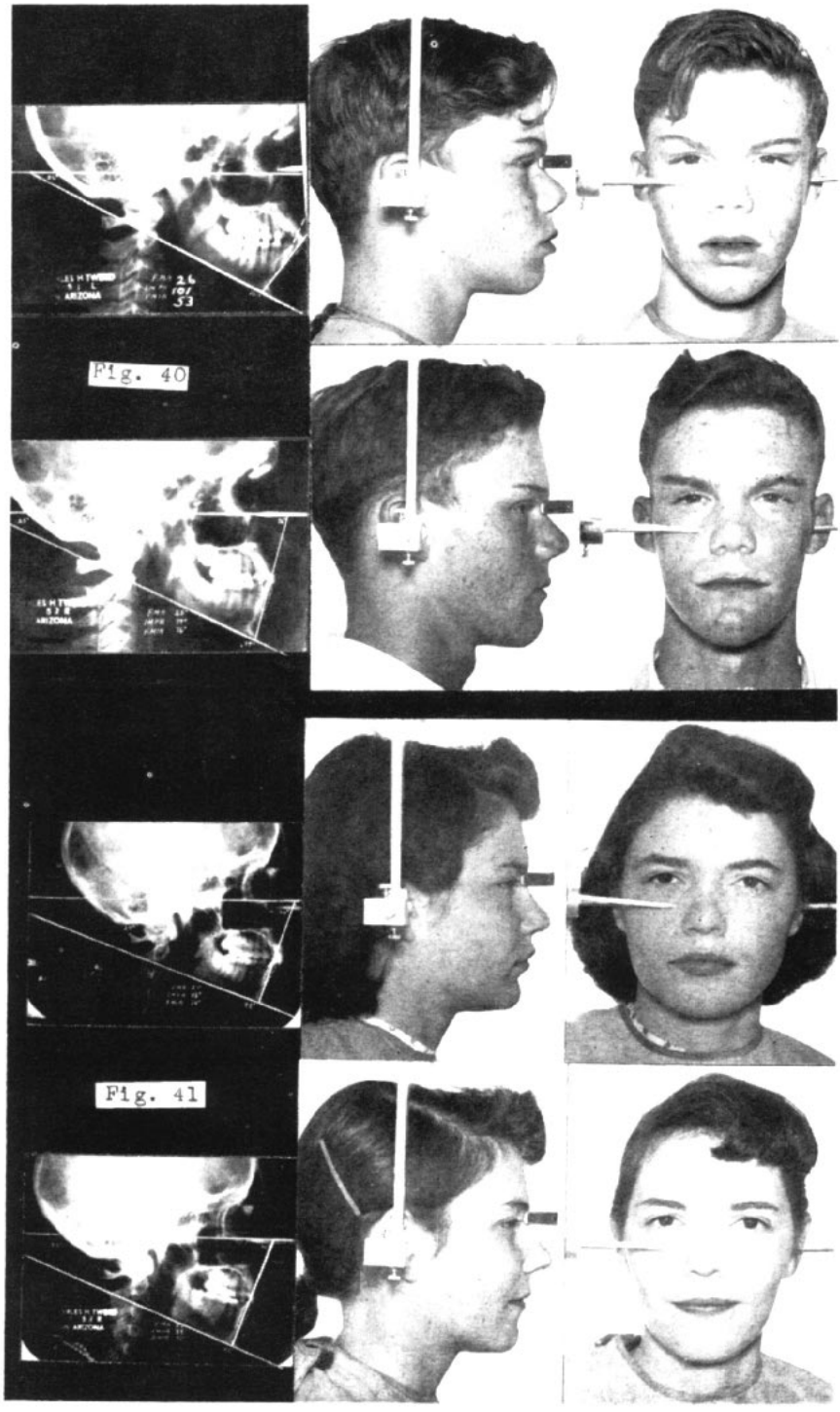
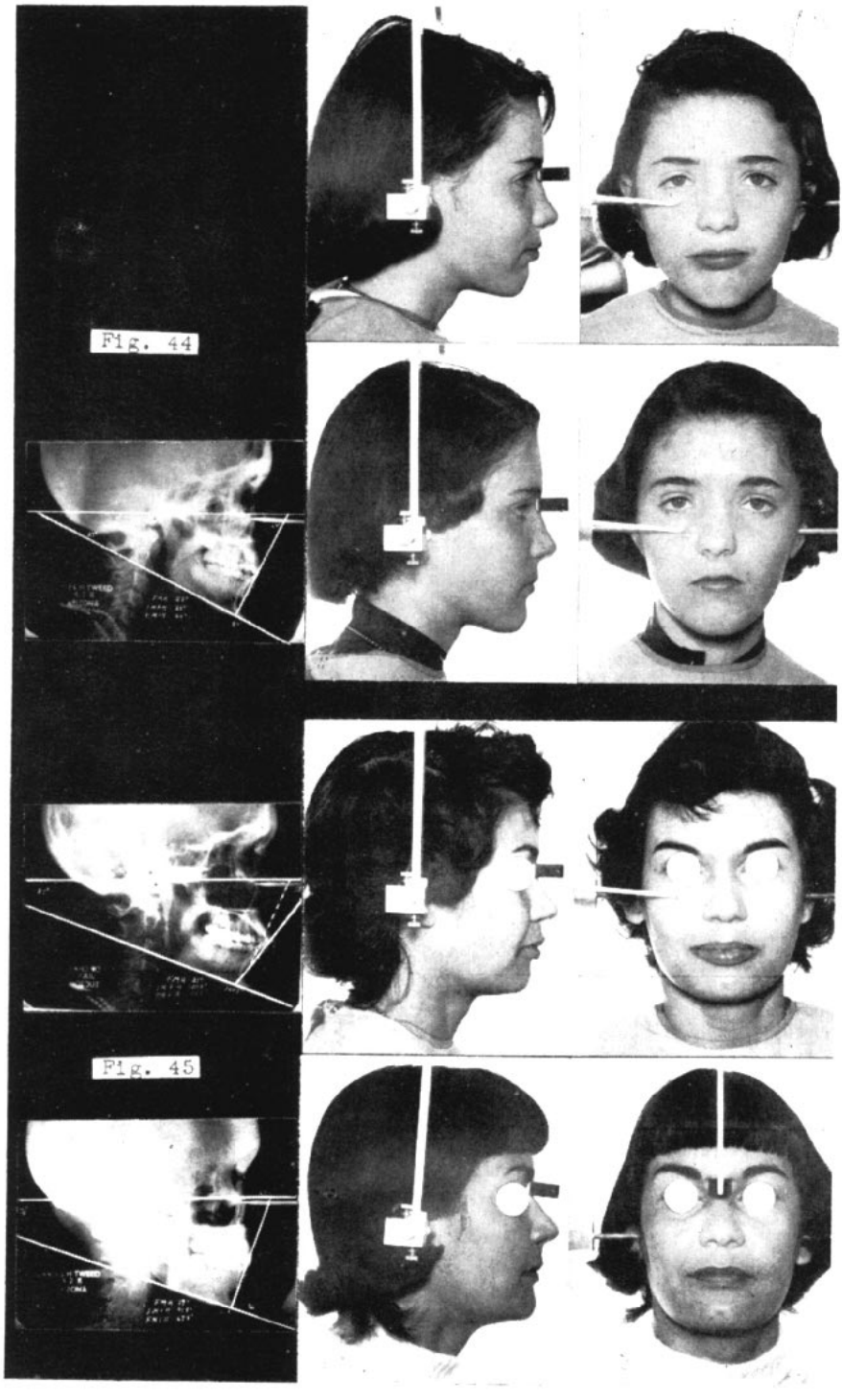


Fig. 42

Fig. 43



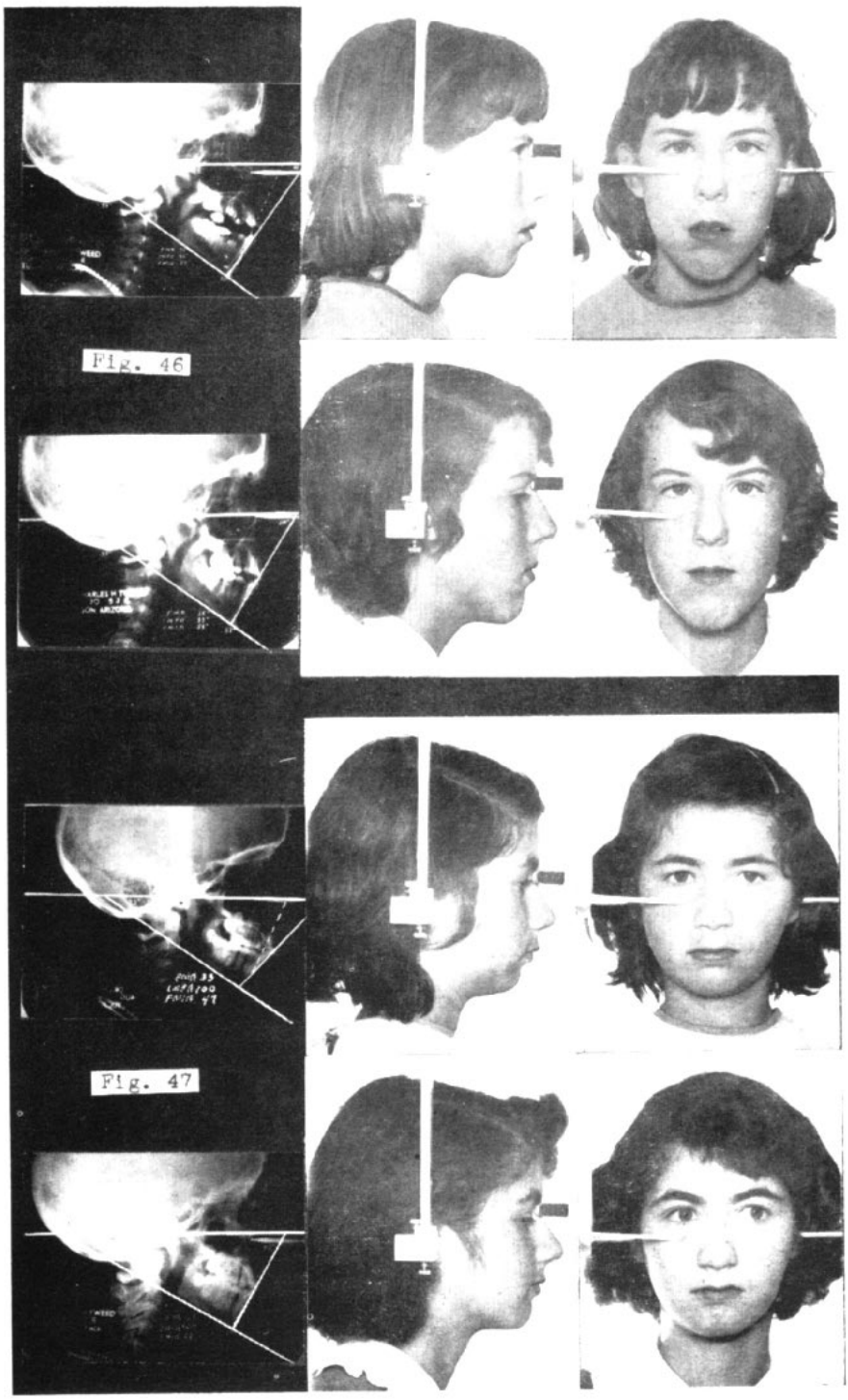
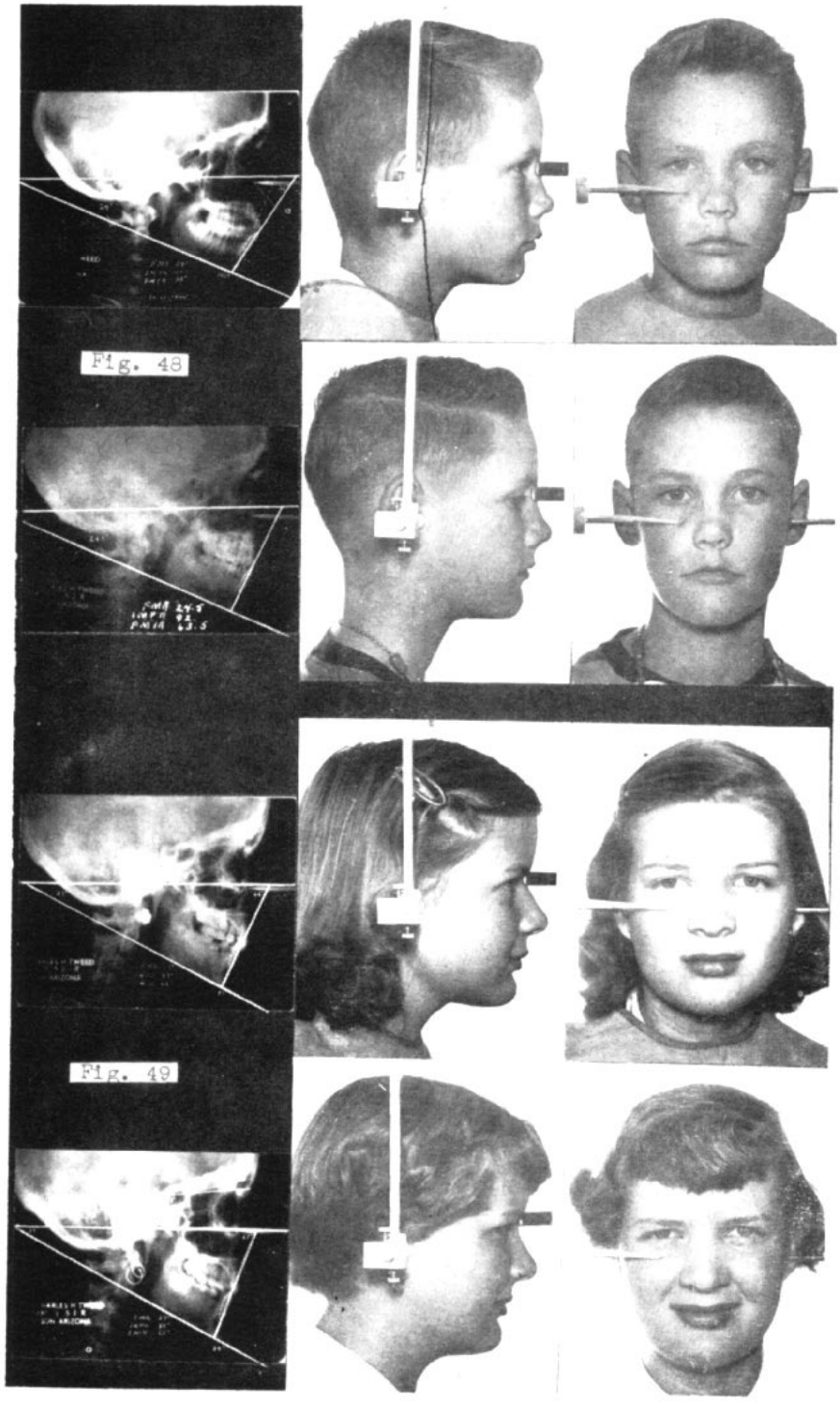
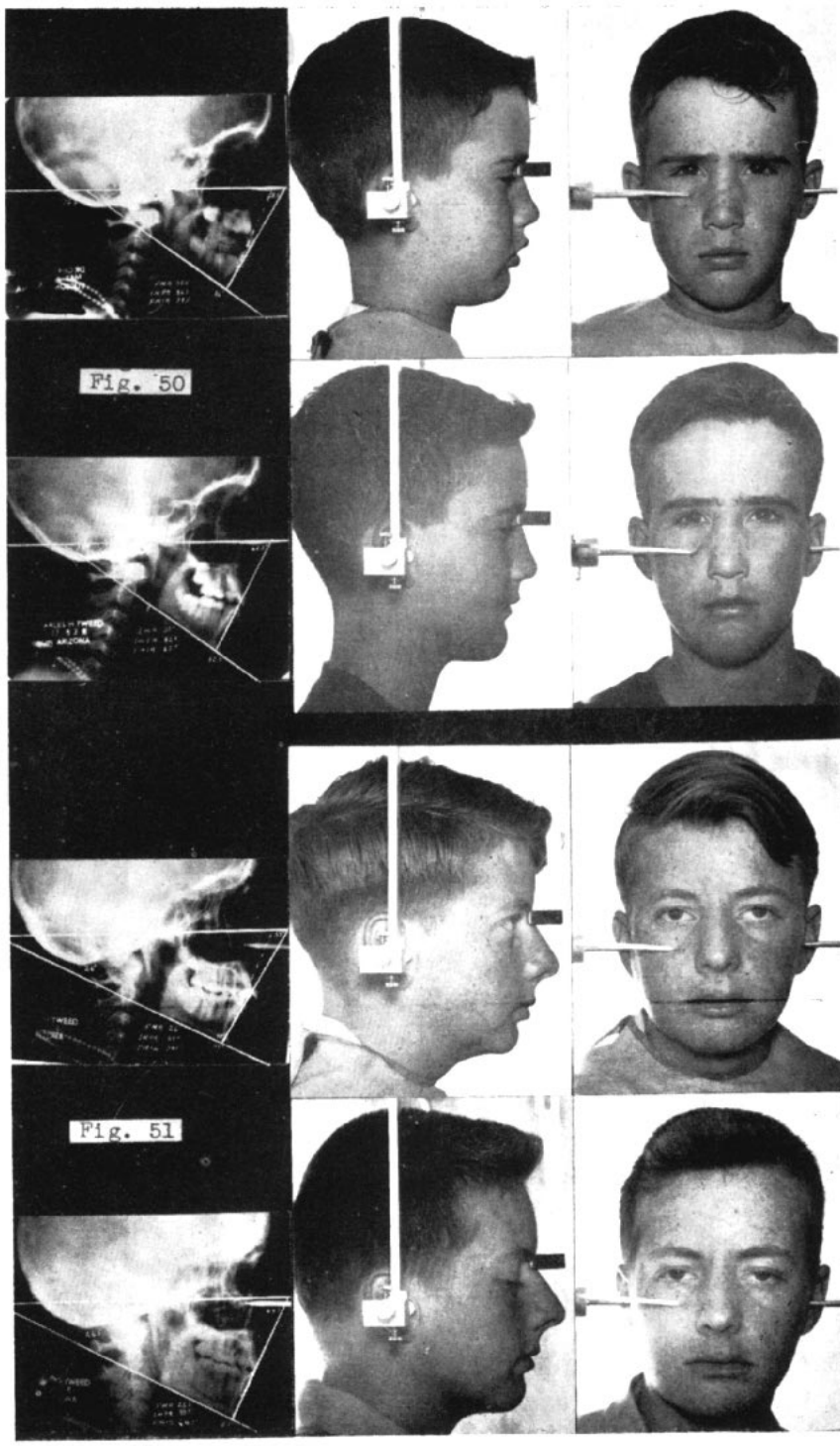


Fig. 46

Fig. 47





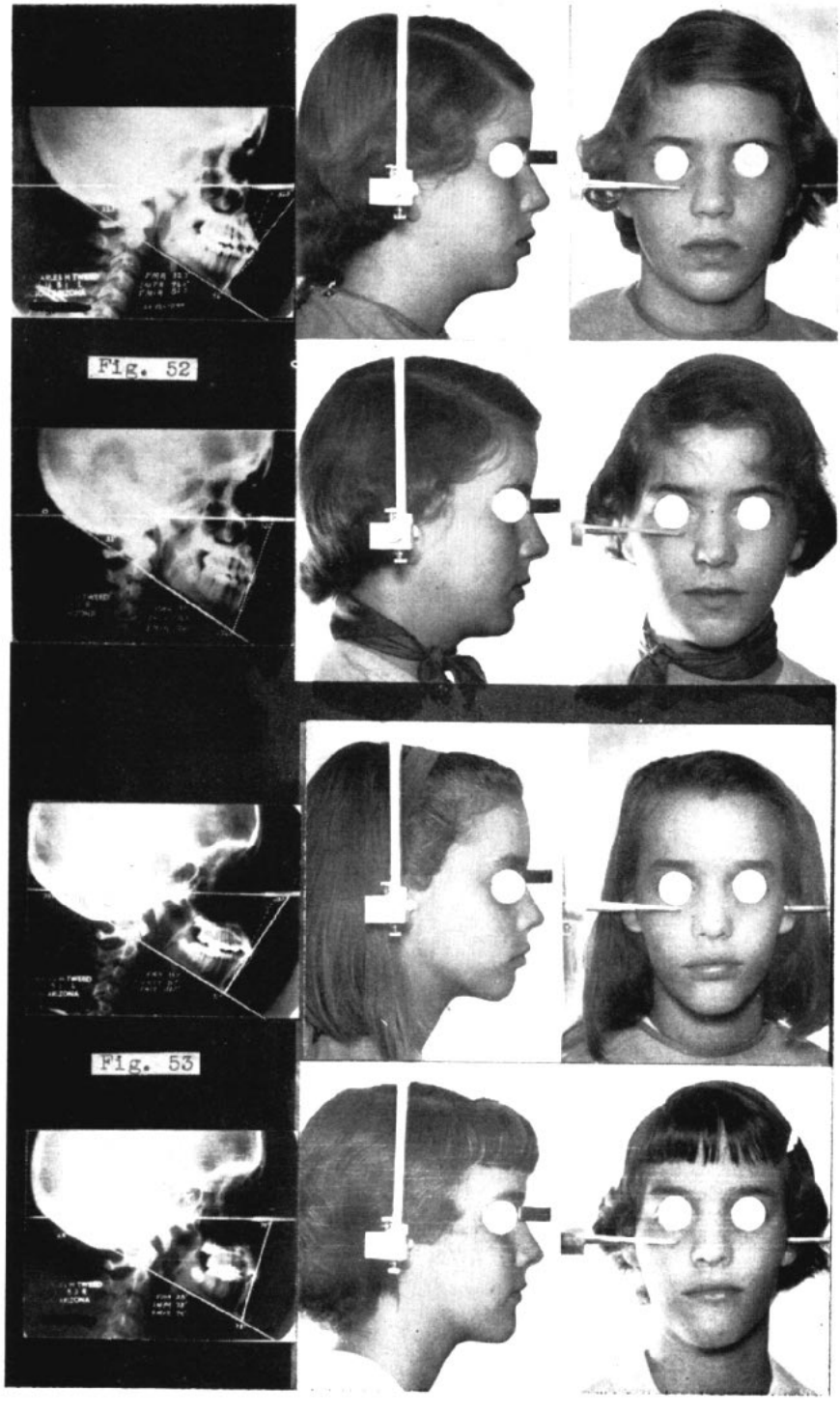
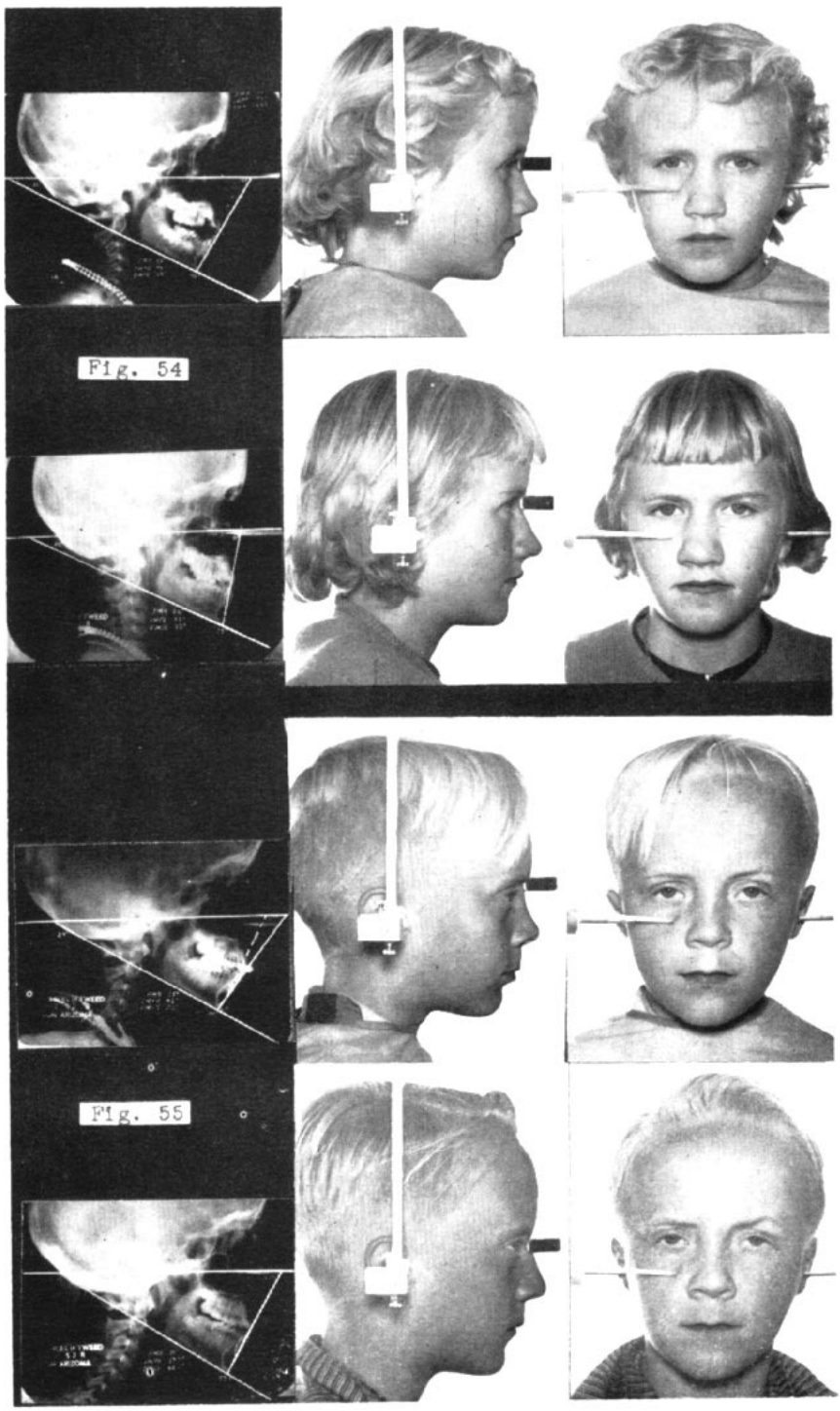


Fig. 52

Fig. 53



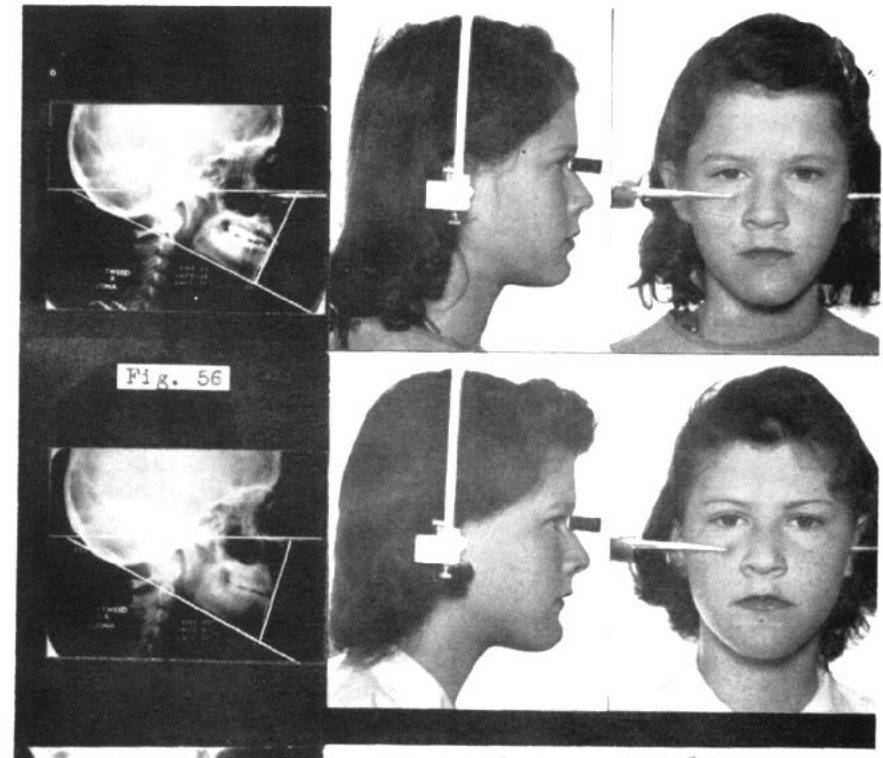


Fig. 56

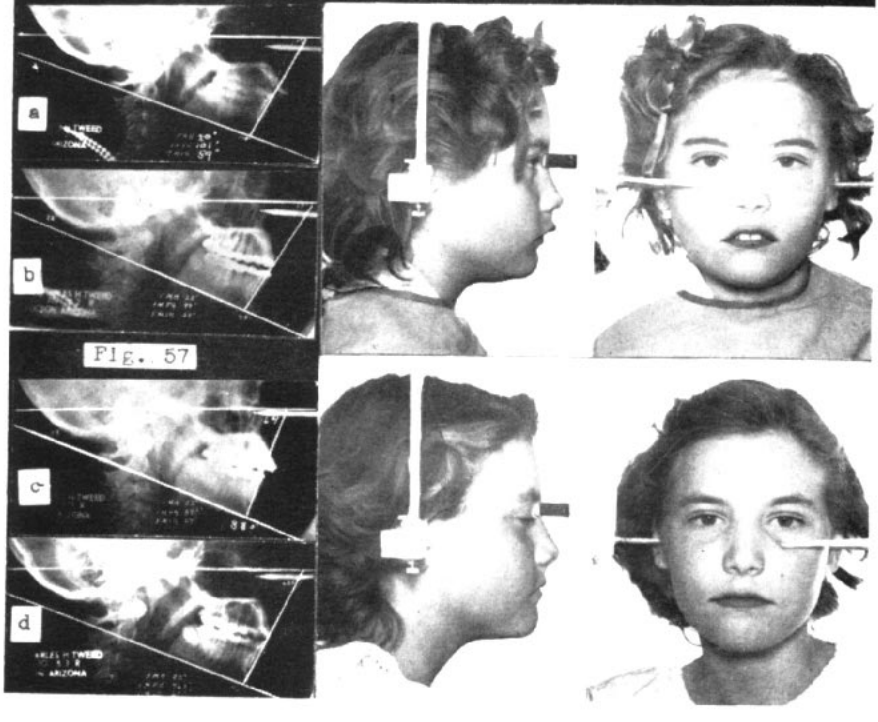
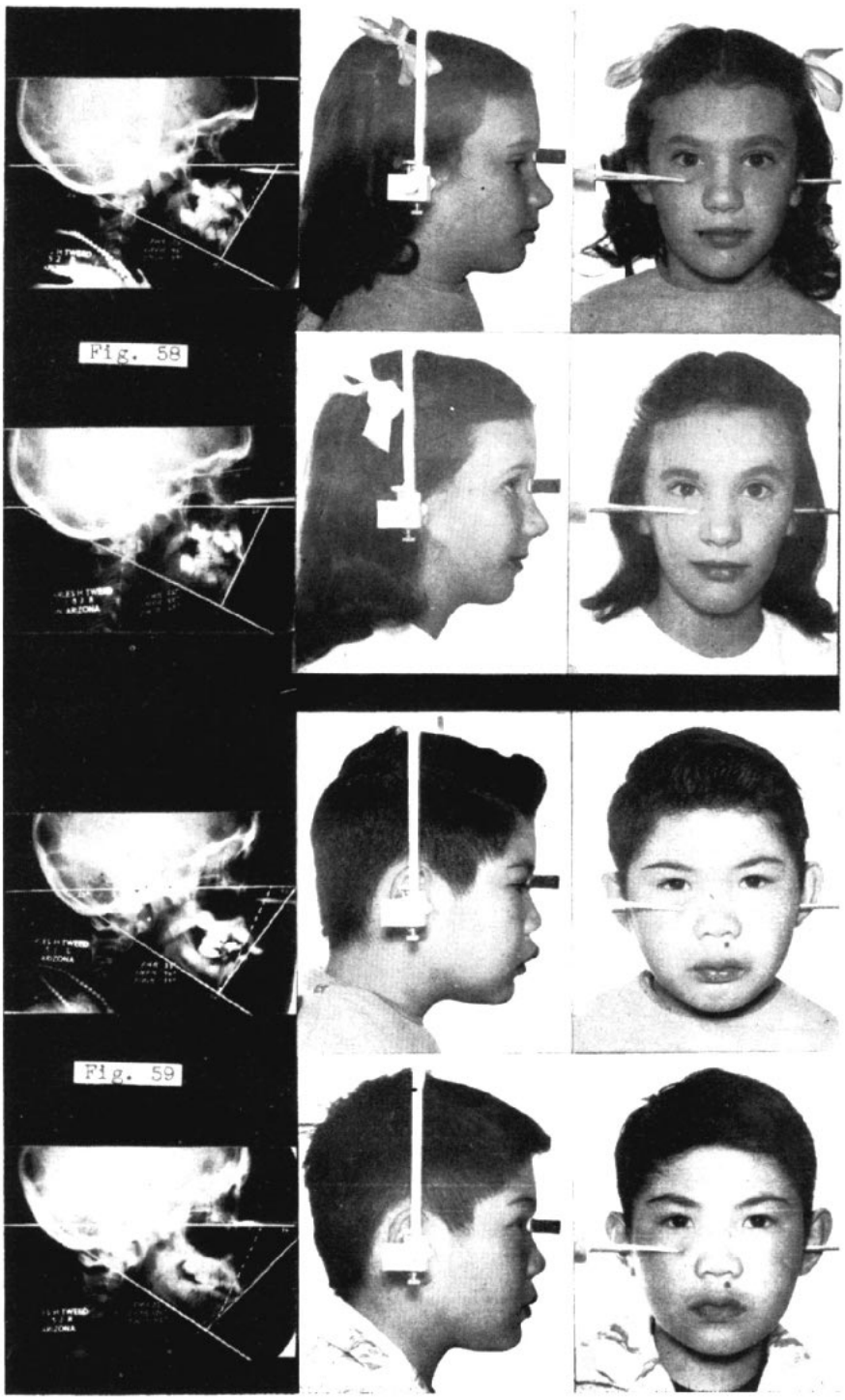


Fig. 57



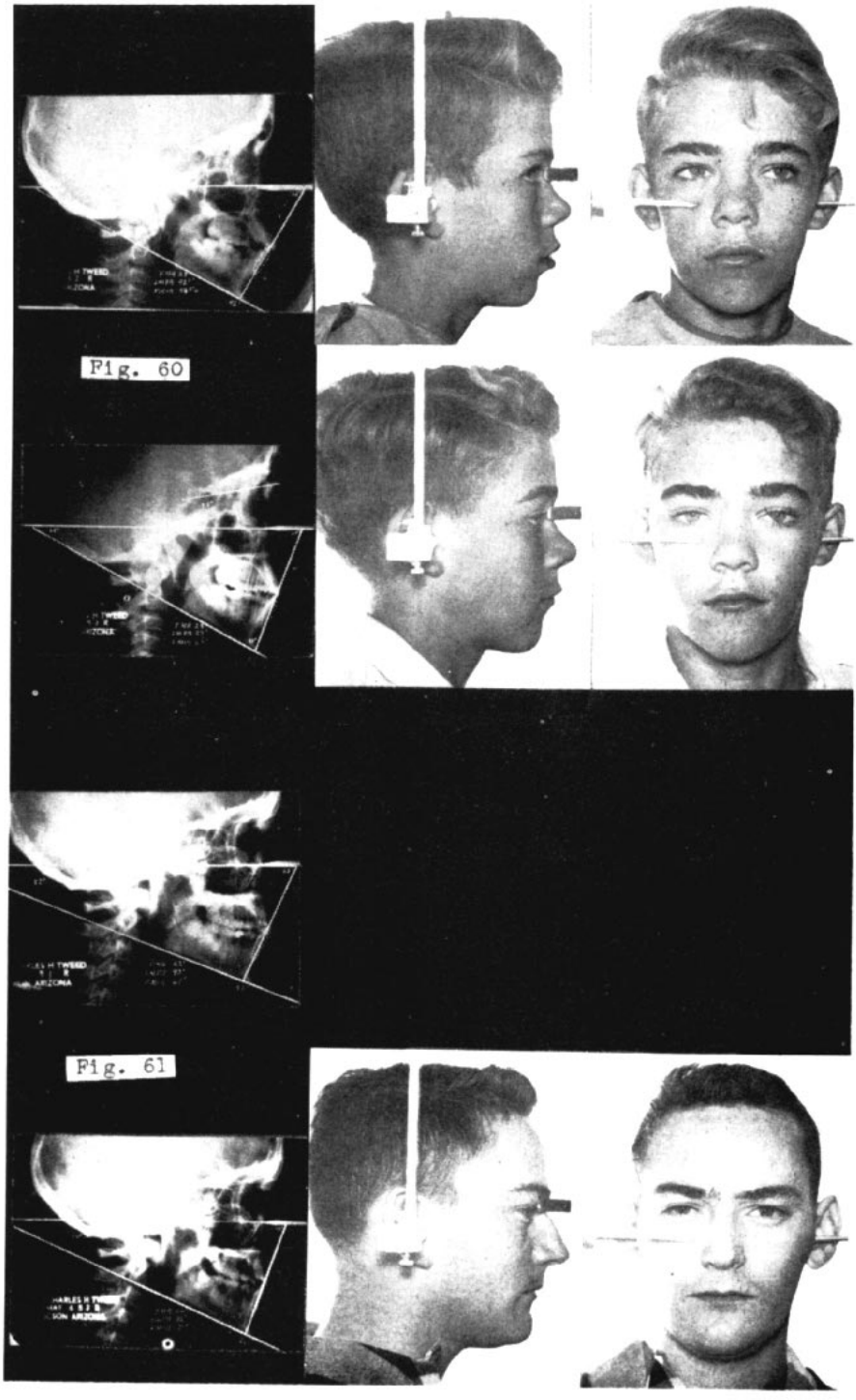


Fig. 60

Fig. 61

Fig. 62

Fig. 63

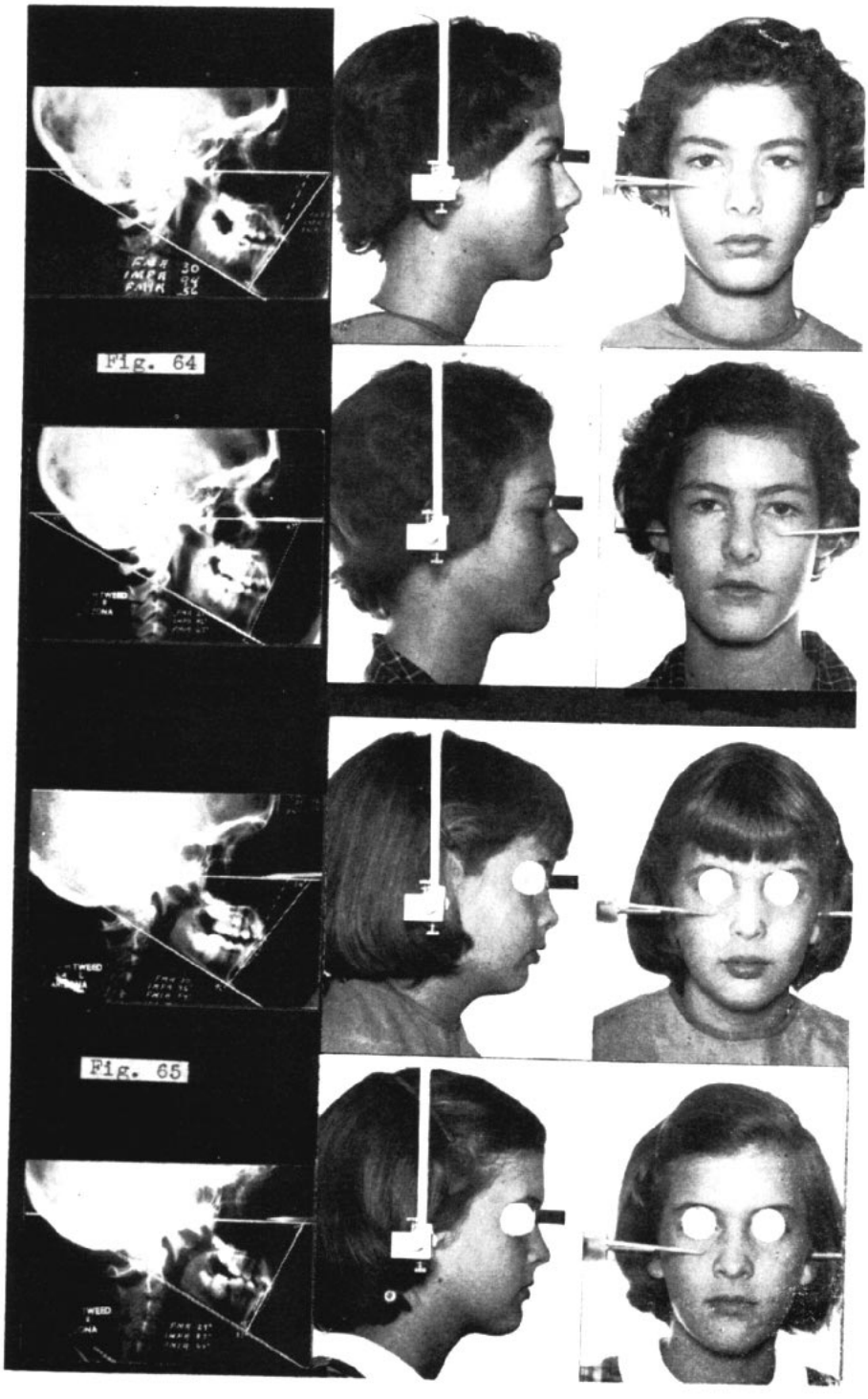


Fig. 64

Fig. 65

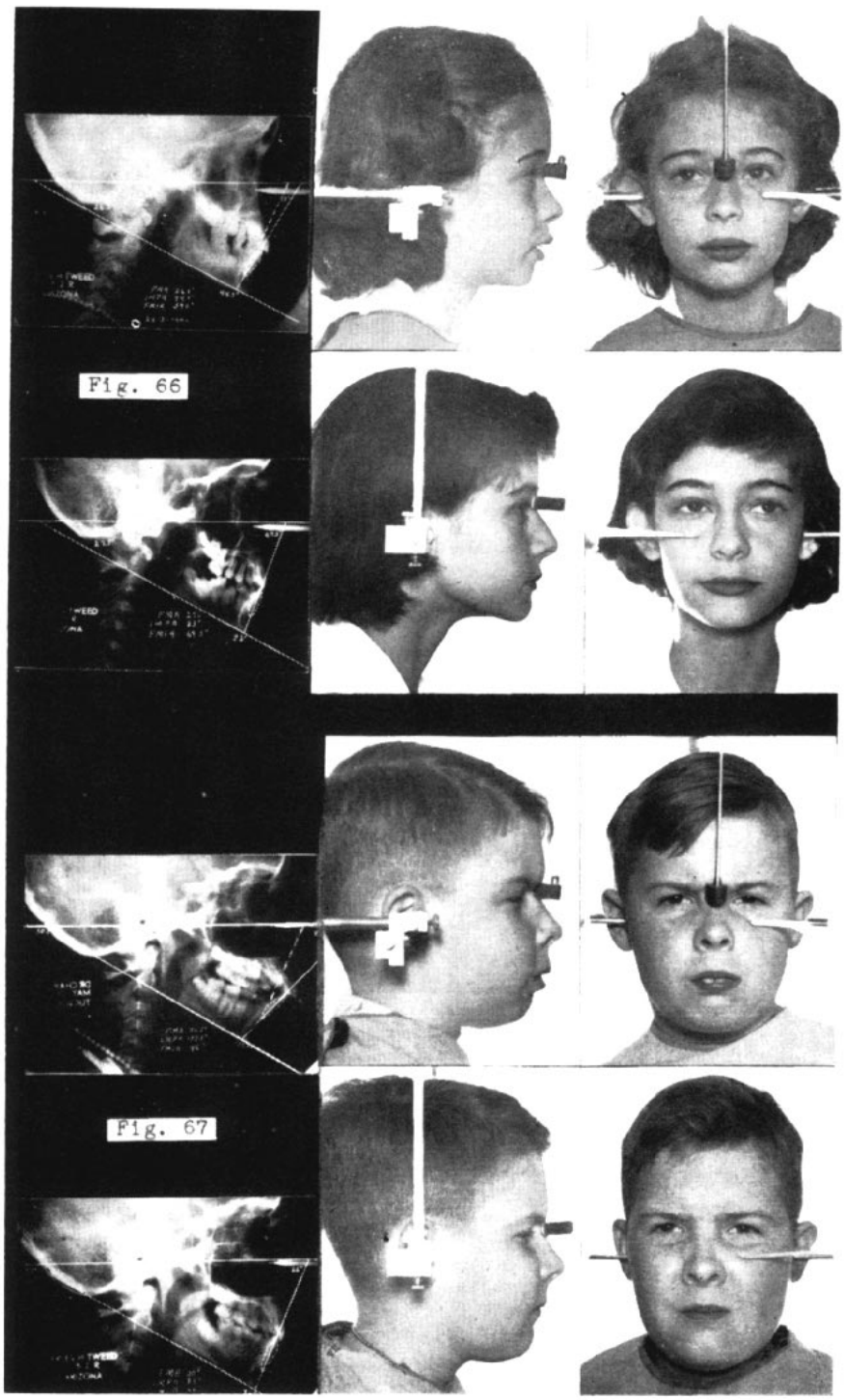


Fig. 66

Fig. 67

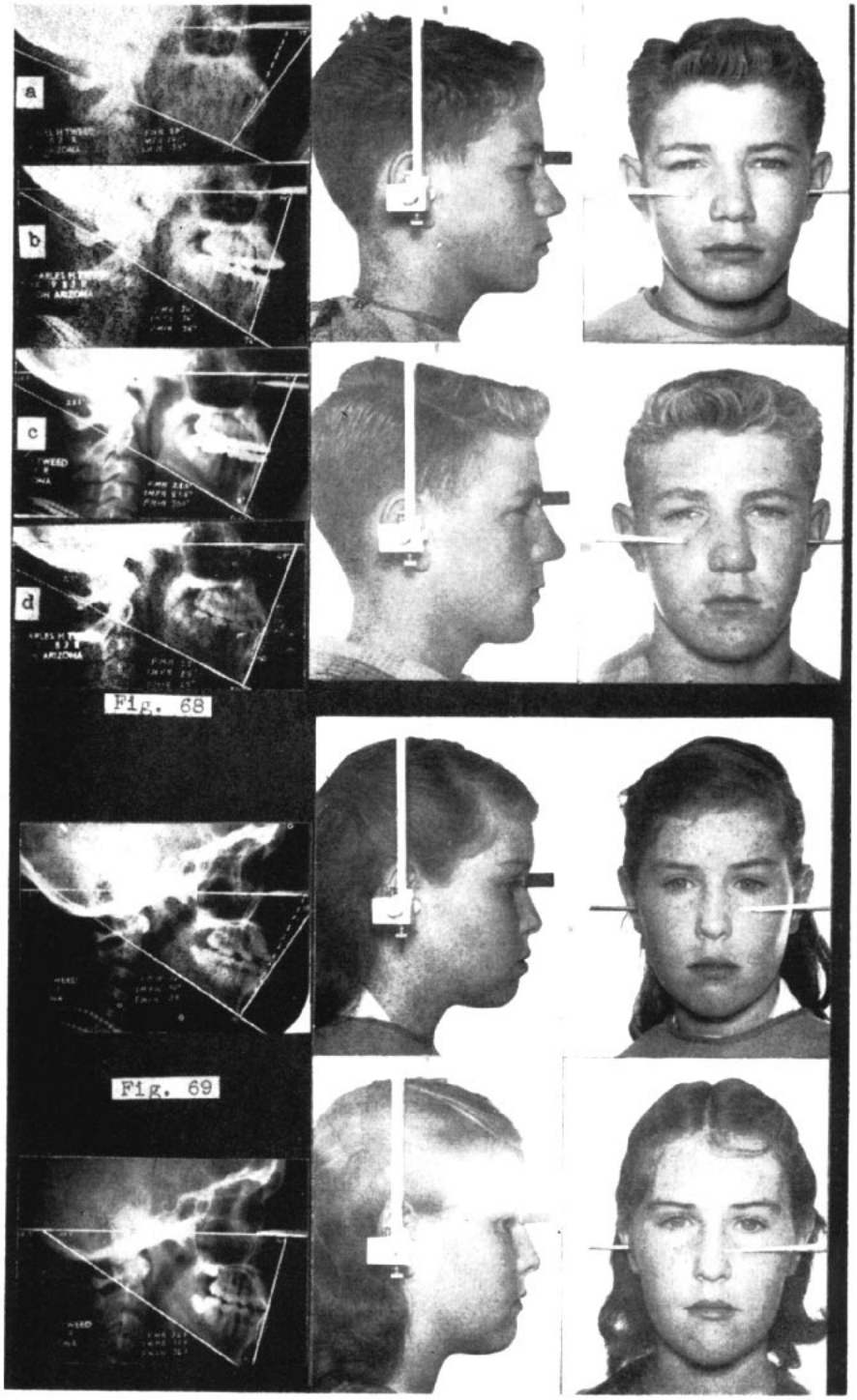


Fig. 68

Fig. 69

at an angle of 65°. The distance between the solid line, which is the existing inclination of the mandibular incisor, and the dotted line, which is the desired incisal inclination (measured at the incisal edge of the mandibular incisor), is the distance in millimeters that the mandibular incisors must be tipped lingually to satisfy the minimum requirement for an FMIA of 65°. Experience has demonstrated that if the case is Class II, there will be a 5° anterior displacement of the inclinations of the mandibular incisors in making the Class II correction. Therefore, anchorage preparation in the mandibular arch must be such that the inclinations of the mandibular incisors when related to the Frankfort plane are 70° prior to the beginning of Cl. II mechanics in the treatment of Cl. II malocclusions.

Fig. 68-b. When the operater feels that he has attained the correct positions of the mandibular incisors he takes another lateral head plate, draws in the triangle and is guided by what he finds. If he has not tipped the teeth back to the minimum requirement of FMIA of 65° for Class I cases and 70° for Class II cases he must continue the action to attain his goal, then check with another lateral head plate. This we call anchorage preparation.

Fig. 68-c. When anchorage has been prepared, Class II treatment is instituted. Upon completion of the Class II treatment another lateral head x-ray is taken and the angles measured. Fig. 68-d. If the FMIA is 65° or more and facial esthetics are pleasing, then detailed tooth positioning is completed and the case retained. The final lateral head plate is made at that time. If one finds after the correction of the Class II condition some anchorage has been lost (Fig. 57b), indicated by an FMIA of less than 65°, a head gear is placed on the maxillary arch and Class III mechanics utilized to again set up the anchorage to attain a minimum FMIA of 65°. Fig. 57-c. This is later followed with more Class II treatment. Fig. 57-d.

A word here: no one will ever be able to present a foolproof treatment procedure based on cold angles and what I am presenting is no exception. While it is true that by blindly following this formula, facial esthetics will be from good to excellent in 90% of the cases, in the remaining 10% there can be no substitute for the eye. Occasionally one will find patients whose facial esthetics are unsatisfactory even though the requirements of this formula have been fulfilled. Therefore, the eye must be the deciding factor in these unusual cases. The FMIA of 65° works beautifully in most instances but there are occasional patients who require an FMIA of as much as 75° to attain their best in facial balance. (Figs. 53-69-77).

Perhaps you will be interested in my method of analyzing a mixed dentition case utilizing the lateral head x-ray, photographs, four intra-oral x-rays and a chart. Available space is taken directly from the mouth and transferred to the chart (Fig. 83). The teeth are individually measured and all lost space occasioned by rotations or blocked out teeth recorded on the chart. On the second line, labelled "required space", the mesio-distal breadths of the four lower incisors are transferred from the mouth to the chart. Four intra-oral x-rays of the buccal and canine areas of the mandibular arch are taken (Fig. 84). These are used to get the mesio-distal breadths of the unerupted mandibular cuspid, 1st bicuspid and 2nd bicuspid teeth. X-rays are taken of both left and right sides in order to get all correct measurements of unerupted crowns. A lateral head x-ray, with the teeth in occlusion, and photographs are taken, the patient is dismissed and the

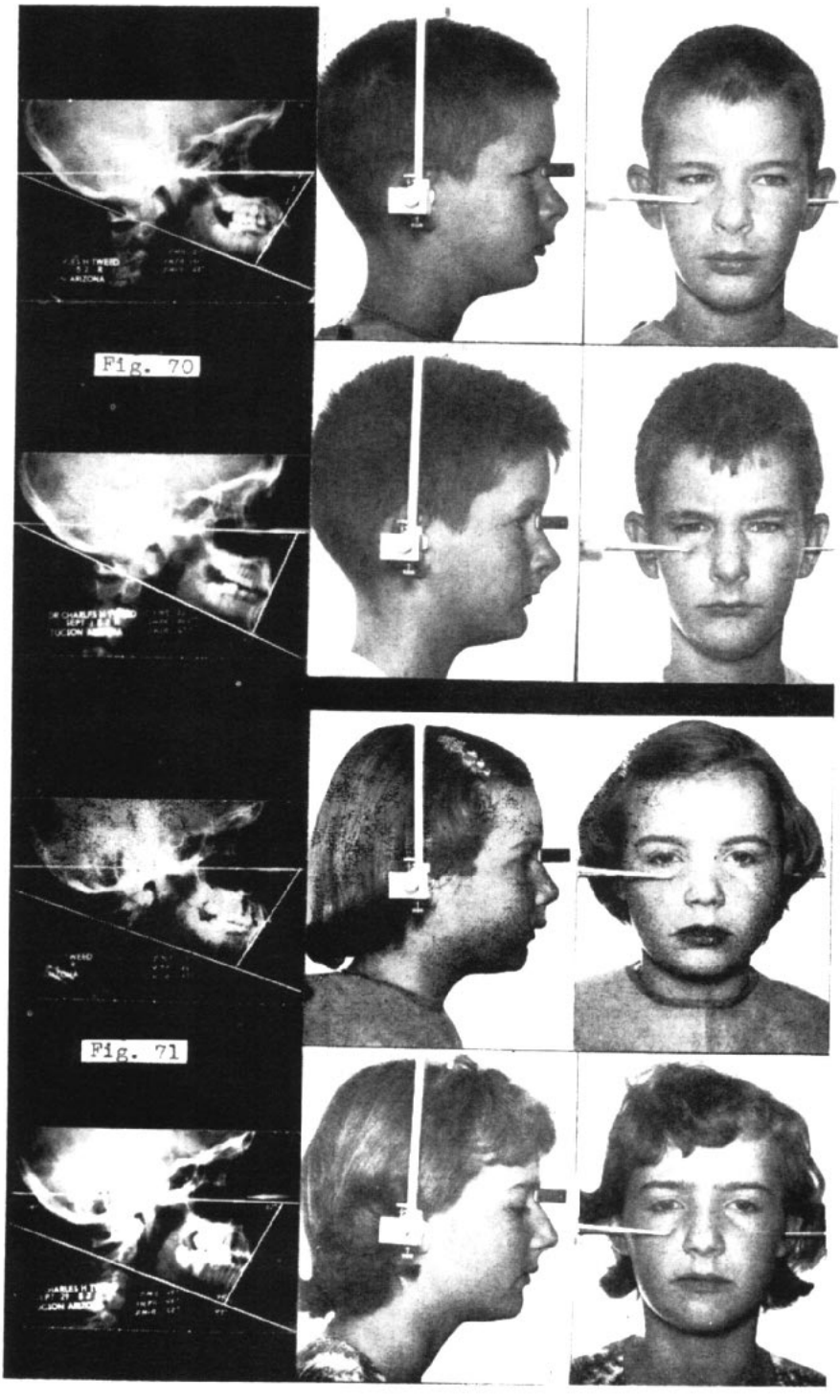
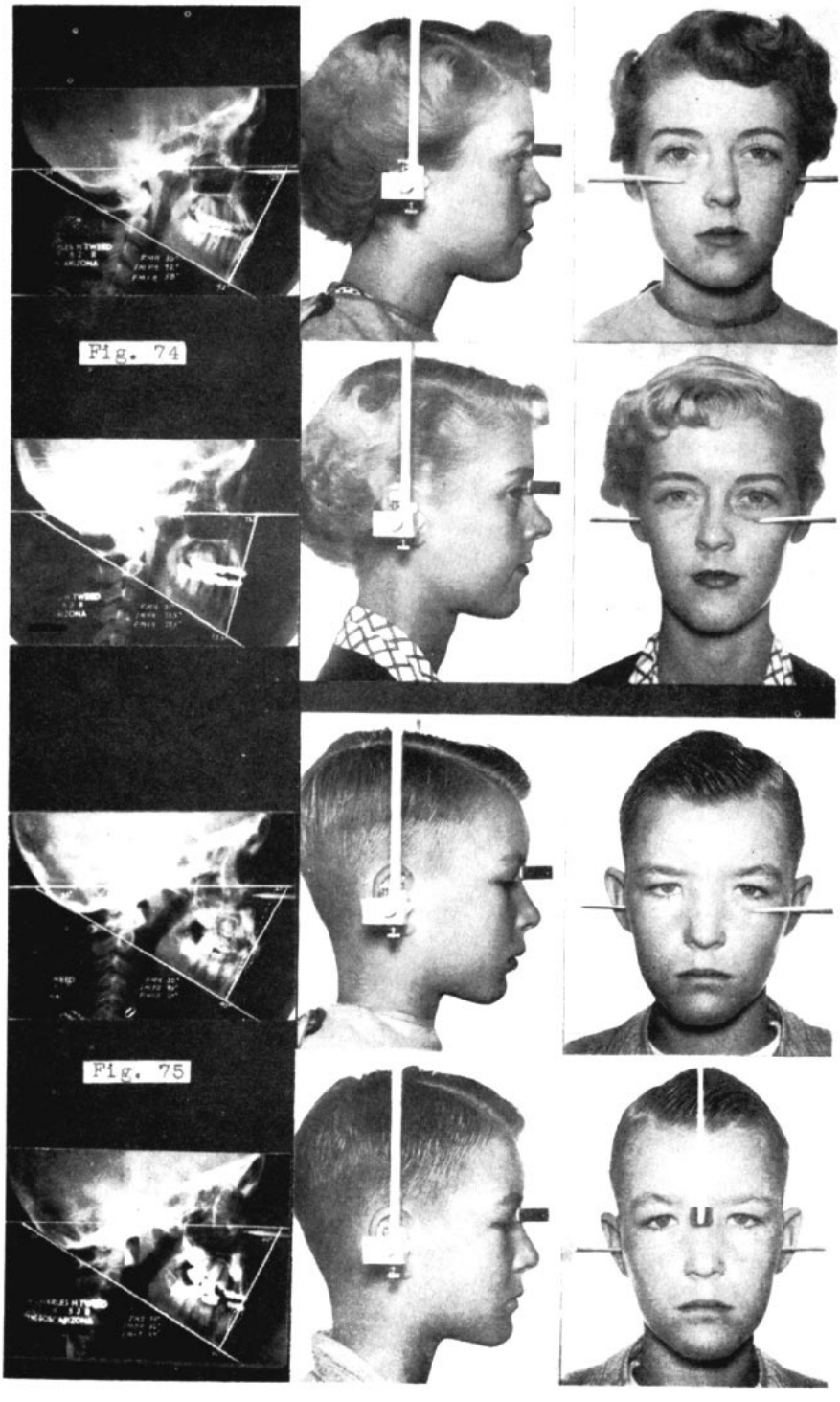


Fig. 72

Fig. 73



Figs. 40 to 76. Facial photographs and profile X-rays (before and after treatment) of thirty-seven patients treated consecutively using the angular values described in text and tabulated in Chart 2.

parent is given a thirty minute appointment to discuss the needs, if any, of the patient (Fig. 76).

Fig. 76-a. The triangle is drawn on the head plate as outlined above. The dotted line from the apex of the mandibular incisor to Frankfort plane forming an angle of 65° is likewise drawn. The FMIA is 53° in the case being discussed. This means that the mandibular incisors must be moved lingually 12° to secure an FMIA of 65°. Twelve degrees is approximately 5 mm. Arch length will be decreased approximately 5 mm. on either side for a total of 10 mm. Ten mm. is substracted from the available space as outlined on the chart. When this subtraction is made, we have the corrected available space. Available space was 69½ mm. By subtracting 10 mm. from 69½ mm. we would have 59½ mm. as the actual corrected available space. We now check the intra-oral x-rays and carefully measure the mesio-distal breadths of the mandibular cuspid, 1st bicuspid and 2nd bicuspid teeth and transfer these measurements to the chart on the line marked "required space". We had previously taken the mesio-distal breadths of the central and lateral incisors and recorded the measurements on the chart while the patient was in the chair. We add these measurements and find the required space is 76 mm. True available space is 59½ mm. and we have a discrepancy

of 16½ mm. which is as much as the mesio-distal breadths of both mandibular first bicuspid teeth. This means that the malocclusion is a clear cut extraction case of a most severe nature and that perhaps it might be best to start some treatment in the near future such as serial extraction of deciduous teeth and early removal of 1st bicuspid teeth. This may prevent the development of a serious maloccusion and minimize the mechanics of treatment to a great extent when all of the permanent teeth have erupted.

Now, suppose that we had discovered that the difference between corrected available space and required space was only 4 mm. If we found this to be true it would then behoove us to note the inclinations of the mandibular 1st permanent molars. If they were appreciably tipped forward it would be quite possible to regain 2 mm. of space on either side in tipping these teeth distally to anchorage preparation position (Fig. 75). One would therefore, take this into consideration and perhaps endeavor to treat the case without the removal of teeth. On the other hand, if the discrepancy between available and required space turns out to be 10, 15 or 20 mm., one immediately realizes that eventually the patient must lose four bicuspid teeth. The degree of the discrepancy gives one a very accurate idea concerning the difficulty that will be encountered in treatment. Correct timing for beginning treatment is of utmost importance in these cases.

In the permanent dentition the same procedure is followed except that one measures directly in the mouth of the patient the extent of the loss in arch length, which may vary from zero in Class II cases to as much as 5 to 10 mm. A notation is made on the examination card and no chart is necessary. Let us say there has been 5 mm. loss in arch length due to irregularities. The lateral head plate is taken and the triangle drawn as previously described. A dotted line connecting the apex of the mandibular incisor with the Frankfort plane is drawn to form an FMIA angle of 65°. The distance at the incisal edge is measured between dotted and solid lines. Suppose the distance is one mm. only. This means that there will be a shortening of one mm. on either side of the dental arch when these teeth are moved lingually to their correct positions. We refer back to our examination chart and find irregularities have shortened the required arch length 5 mm. To correctly position the mandibular incisors, substract another 2 mm. for a total discrepancy of 7 mm. between available and required arch length. Even taking the inclinations of the mandibular molar teeth into consideration one could not hope to tip the teeth in the buccal segment back 3½ mm. on either side. Hence, the case is an extraction case of mild severity and one would not have to be as exacting in his anchorage preparation as one would if the case presented a discrepancy twice as great or 14 mm.

Applying this method of diagnosis to the practice in which I have shown thirty-seven consecutively treated cases, I find that seven of these cases are non-extraction cases. This would tend to indicate that the utilization of this formula would perhaps result in less, percentage-wise, extraction of teeth in treatment.

Analyzing the results of this project, the implications are that the orthodontist, as a general rule, should endeavor to move the denture posteriorly as far as possible and rarely resort to the intentional mesial displacement of teeth in the buccal segments during treatment.

Is such a diagnosis and treatment procedure as here outlined applicable to every patient that is examined by the

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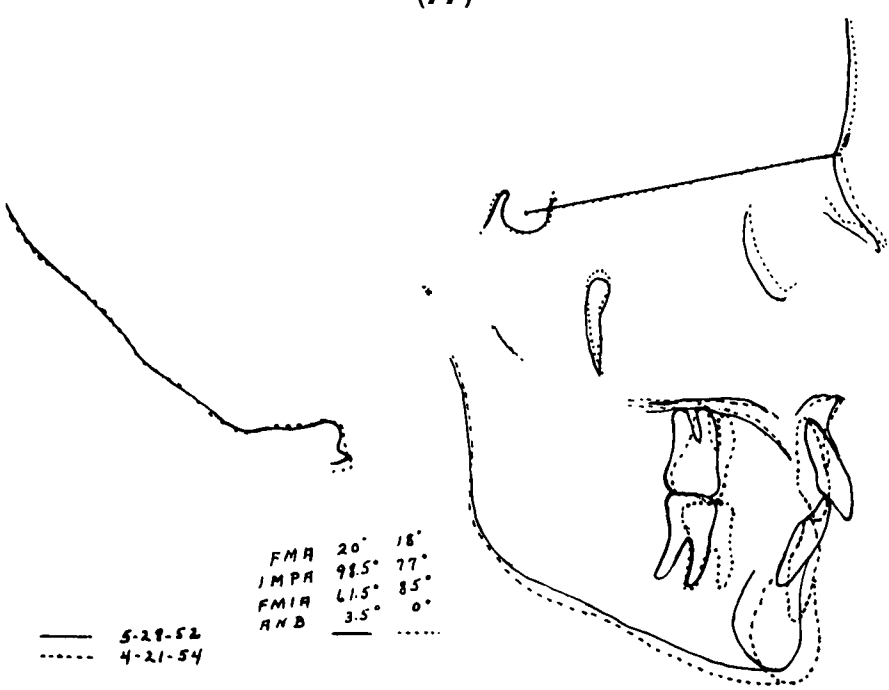

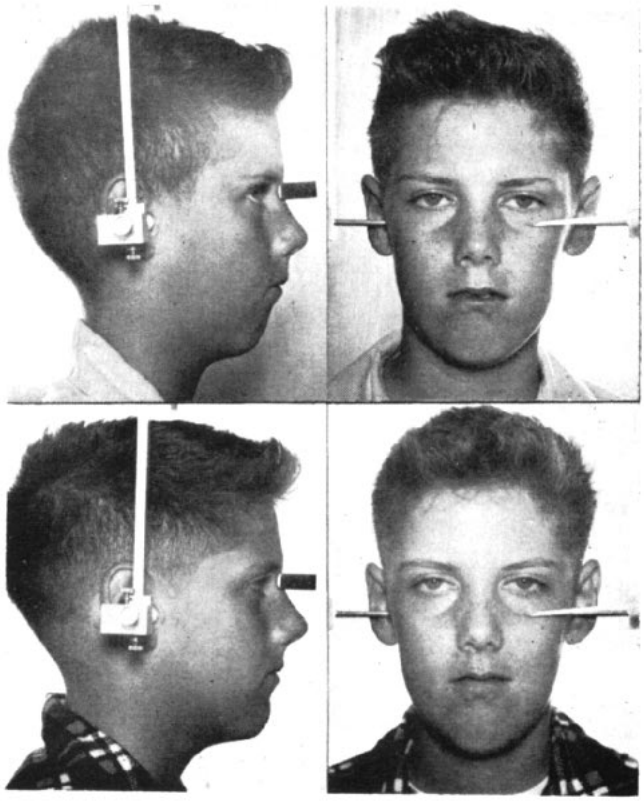

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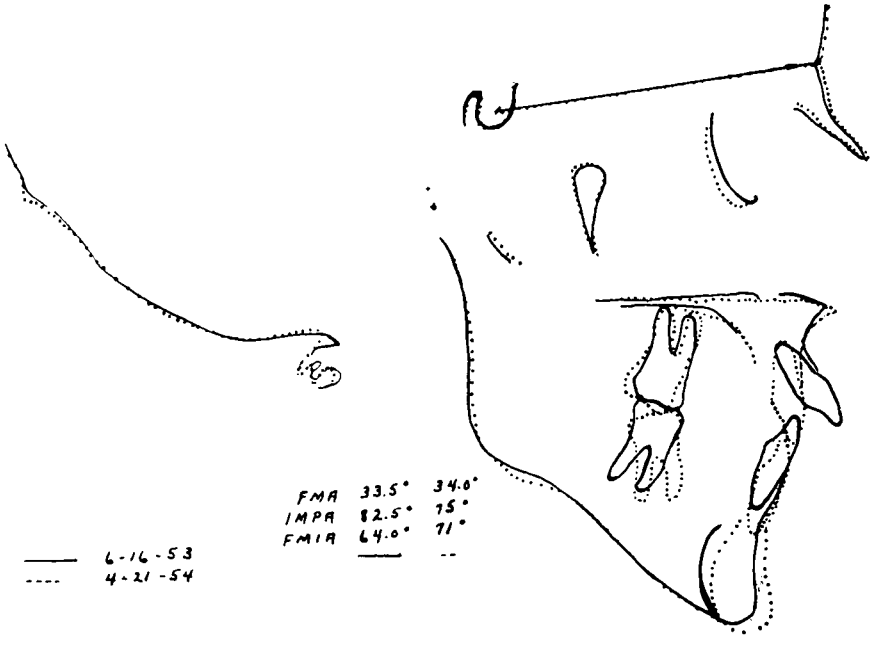

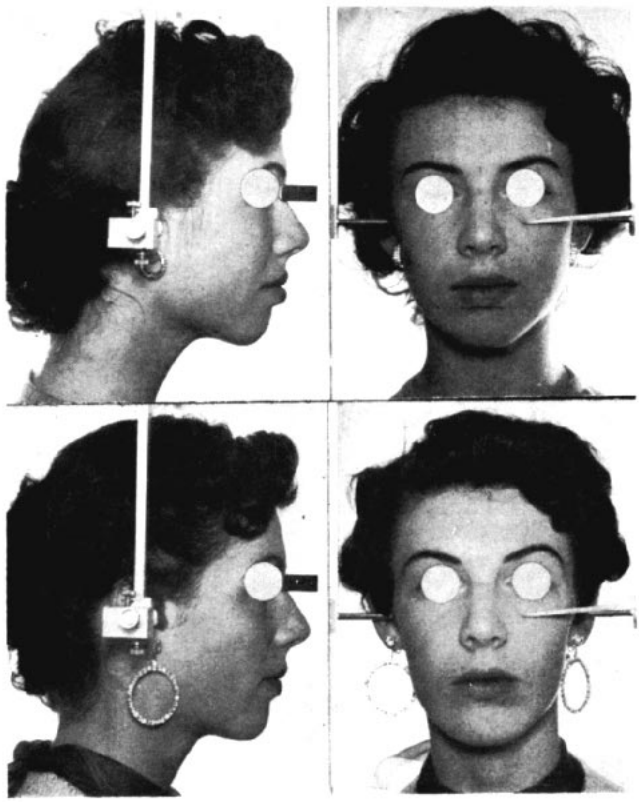

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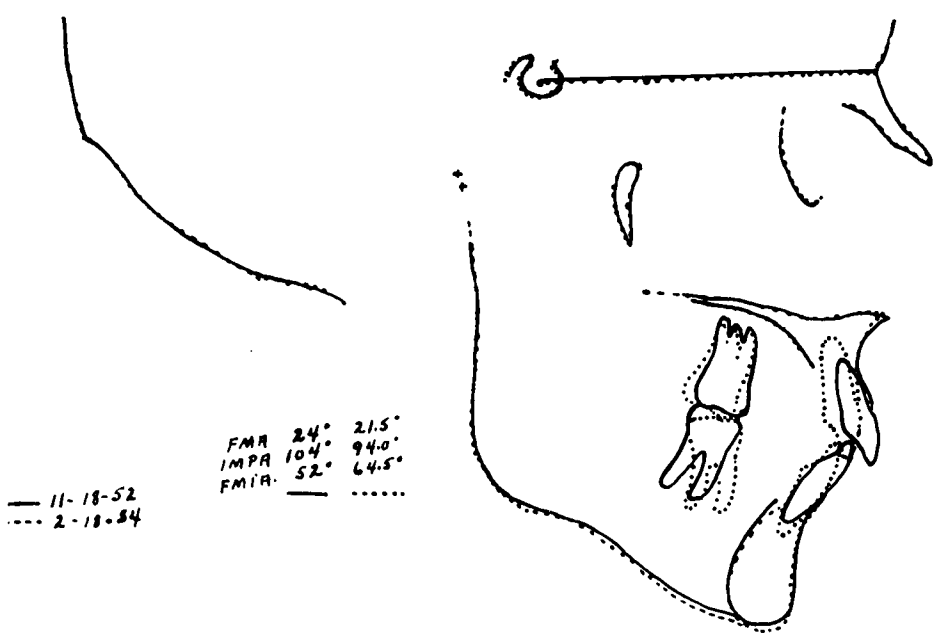

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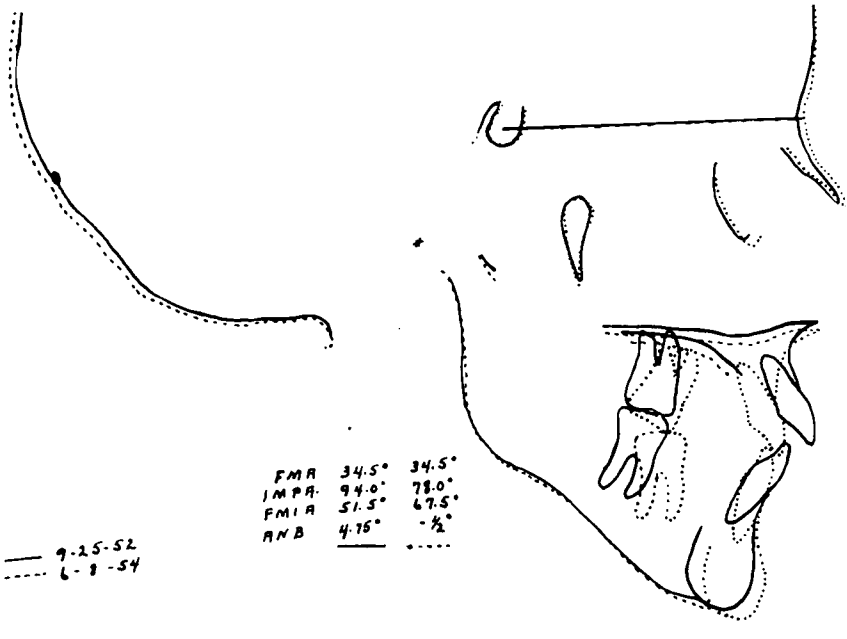

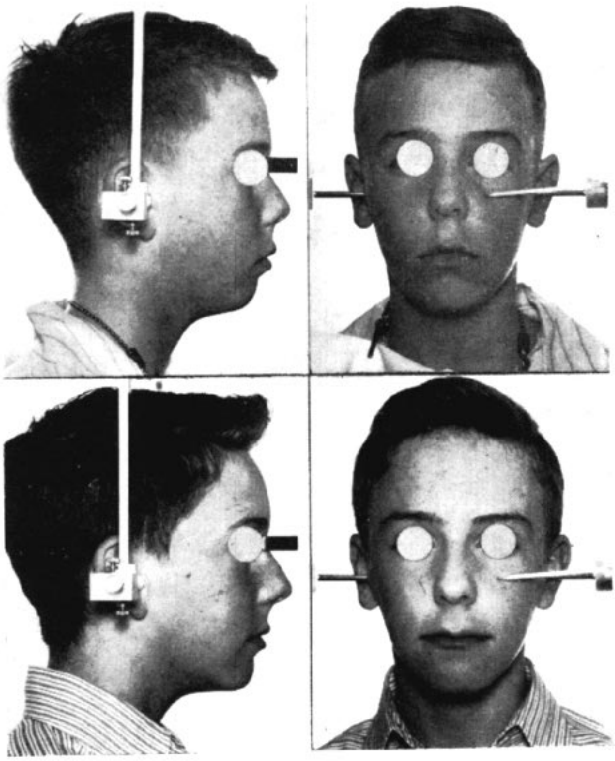

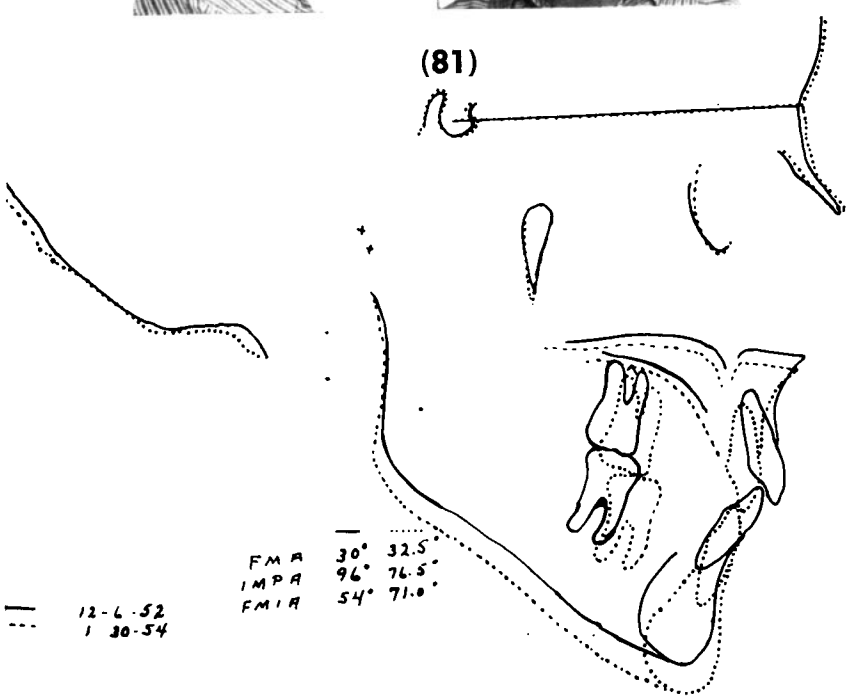

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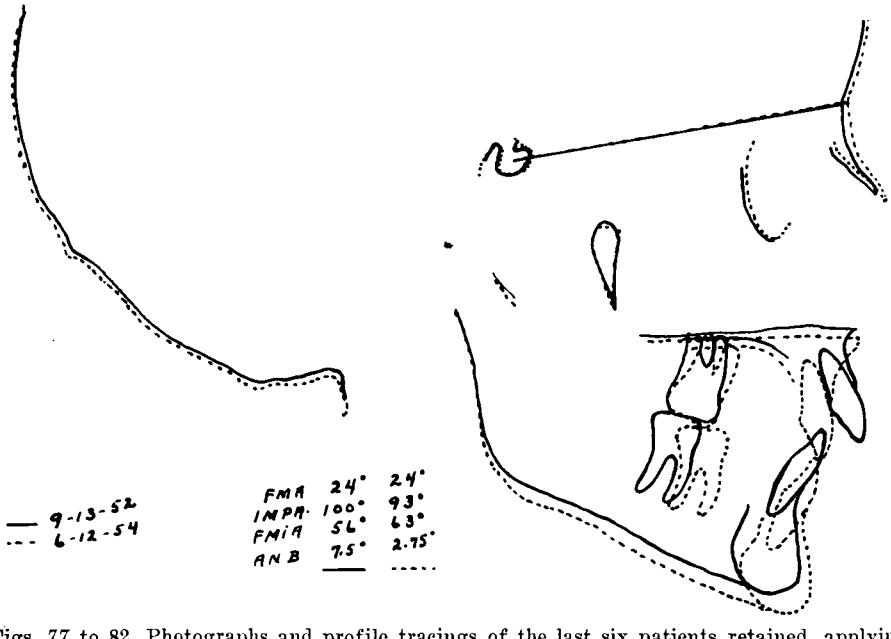

Figs. 77 to 82. Photographs and profile tracings of the last six patients retained, applying the formula in treatment.

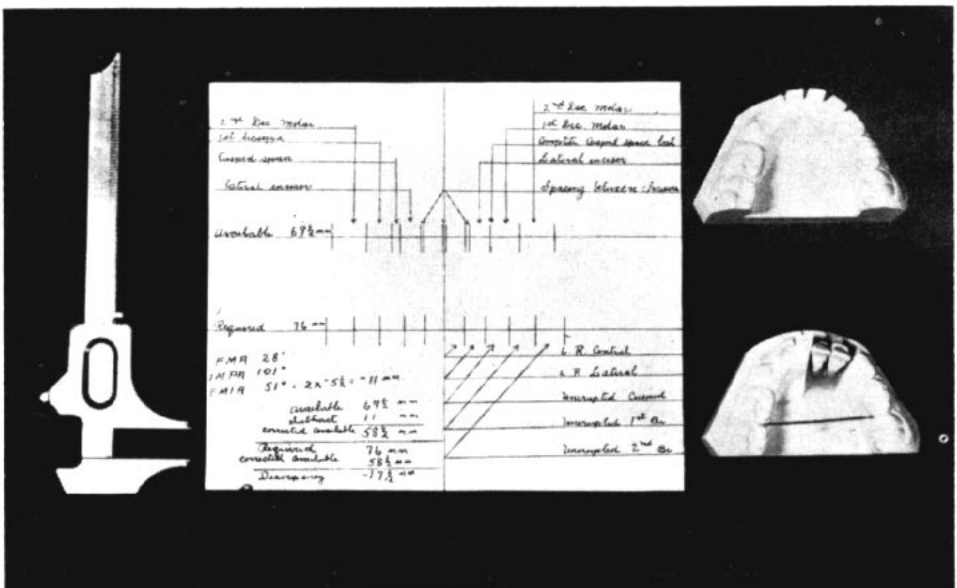

Fig. 83

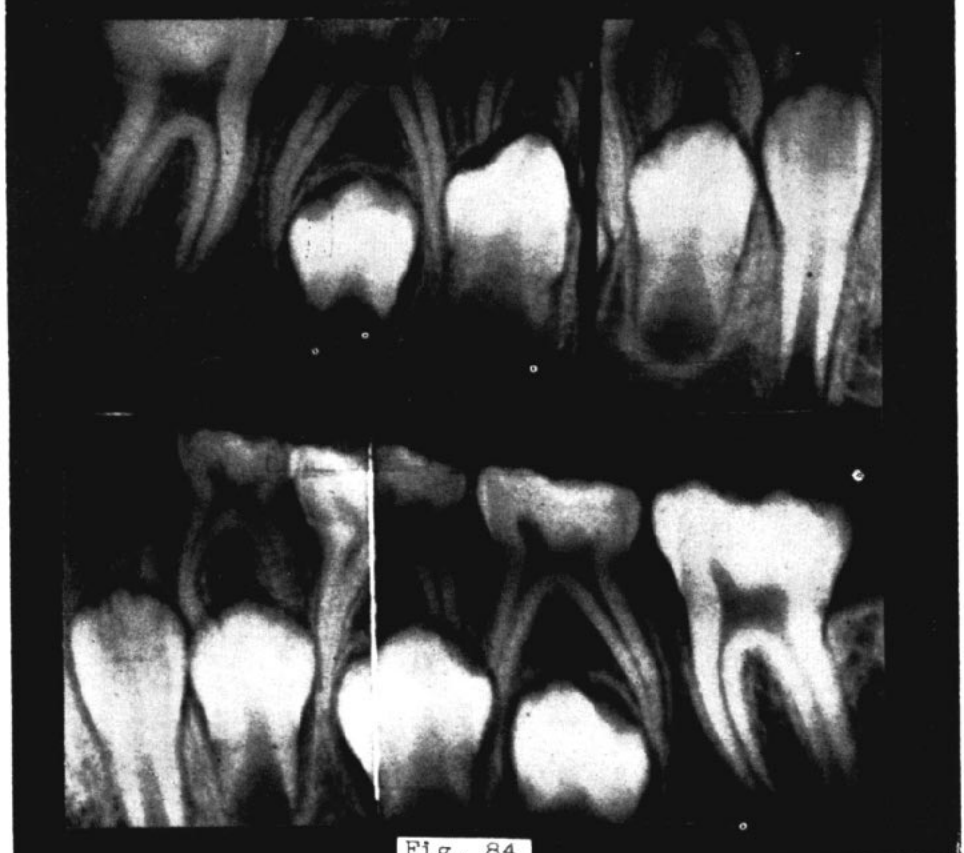

Fig. 84

orthodontist? In my opinion, no. Occasionally the orthodontist will examine a patient in the mixed dentition stage. The case may be something trivial such as an abnormal frenum that separates the maxillary incisors or the case may be Cl. I in nature with flaring incisors. If the analysis discloses that the patient is *not* a discrepancy case and that the mandibular incisors are *not* irregular and that facial esthetics are fair, even though the FMIA be as little as 57° or 58°, I would be very hesitant to advocate the extraction of four first bicuspid teeth to attain an FMIA of 65°.

On the other hand if the mandibular denture was unstable or facial balance noticeably poor, I most certainly would remove all four first premolars and strive for an FMIA of 65° or greater.

This paper is an effort in behalf of the young man to give him a workable guide for his treatment problems. It should be closely studied and followed until such time as a more perfect technique for diagnosis and treatment planning is forthcoming.

2620 *E. Broadway*

*EDITOR'S NOTE to Fig. 39: Mandibular planes and lower incisor axes, and angular values thereof, have been added to the original illustrations by Dr. Tweed.

Fig. 83. (above) Method of recording data in analyzing mixed dentition malocclusions.

Fig. 84. (below) Intra-oral X-rays required for measuring unerupted teeth in mixed dentition analysis.