

Esthetics and Its Relation to Orthodontic Therapy

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"The principle consideration is that we shall encourage the thought that we shall become addicted to observation of esthetic relations." EDMUND WUERPEL

As the three "R's" of Education are "Readin'," "Ritin'," and "Rithmetic," so the three goals of Corrective Orthodontics are "Utility," "Beauty," and "Stability." These prime objectives in orthodontic treatment are directed towards (1) improvement in function (2) improvement in esthetics and (3) the maintenance of these improvements.

Utility

Little has been written concerning utility, or functional efficiency. Heretofore, orthodontic treatment has been concerned with the occlusal relations of teeth in the so-called "centric relation," which is based upon a static concept of occlusion.

Stability

Tweed,² in 1944, evaluated orthodontic objectives placing stability of the end result first and foremost with emphasis upon positioning the lower incisors upright over basal bone. There are other considerations that affect stability of end result such as the balance of musculature labial and lingual to the denture, changes due to growth, etc. That stability is not easily attained is evident in the writings of Lundstrom,³ Nance,⁴ Howes⁵ and others. While retention has been stressed as to mechanics, duration and physiological factors, the answer to questions related

to neutral equilibrium have not been answered to the satisfaction of many competent investigators and clinicians.

Beauty

The scope of this investigation is limited to a consideration of beauty. The question naturally arises, "does orthodontic therapy affect the face, and if so, how are facial relations changed?" Since it is an accepted fact that facial changes do frequently accompany orthodontic therapy, then these changes must be evaluated to determine whether or not they are desirable. Thus, there is a need for study of dentofacial relations, and their effect upon esthetic balance and facial contours.

Orthodontic Ideals

For a moment the author must digress and reconsider the prime objectives of orthodontic treatment. As originally defined above, they are: (1) improvement of utility (2) improvement of esthetics and (3) maintenance of these improvements. This is not enough. Perfection is the ultimate goal to be desired, hence, these aims should be: (1) ideal function (2) ideal esthetics and (3) maintenance of these ideals. The Ideal, by definition, is a "mental image representing the perfect type, regarded as the standard for imitation."

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The concept of establishing normal occlusion has been generally accepted by the profession. Simon,⁶ stated, "on principle, we know that a perfectly normal denture functions best." Is the idea of normal occlusion really a norm concept, expressing average, medial, or central tendency, or is it something more exacting? Hellman,⁷ explained that Angle has substituted the term "occlusion" for mechanical relation and used the word "normal" to indicate the superlative or ideal. This then, IS normal occlusion—PERFECTION. Such perfection does not actually exist, cannot exist, except in the mind. Though the ideal may never be attained, orthodontic procedure must always follow a path aimed at the attainment of the ideal.

History

As far back as John Hunter,⁸ the importance of esthetic relations was realized, for Hunter stated that the esthetic appearance of the mouth is the prime reason for orthodontic procedure. Up to the time of Angle, orthodontic procedure followed the premise of correction for esthetic reasons only. Angle,⁹ himself was much taken with the importance of beauty of the face and wrote that all of the essentials of beauty were found in the face of Apollo, which he used as a guide or standard of beauty.

Later, having met and been deeply impressed by Dr. Wuerpel, Angle disregarded his early concern for esthetics on the assumption that placing the dentures in "normal occlusion" would yield ideal esthetic results. Since the very inception of the "normal occlusion" school, orthodontists have begun to realize that the facial features in individuals with normal occlusion are not necessarily beautiful.

Type

The conflict of opinion concerning esthetics seems to resolve around the possibility and/or desirability of changing facial type! In 1944, Brodie,¹⁰ stated, "we do not believe that we as orthodontists are qualified to pass on the beauty of the human face. Nature has cast each one of us in a different mold and to attempt deliberately to alter the type of the face is presumptuous."

If the various and multiple immutable characteristics that make up the Greek, Assyrian, Nordic and other races are considered, such as blond hair, straight profiles or noses, high arched or flat foreheads, etc., then certainly, orthodontic therapy does not change such type. It is in the writings of Hellman, again, that the answer is forthcoming: "when differences in development become abnormal, they present the same aspect in all racial types and are distinguishable as *malocclusal type*." This is the type that orthodontic treatment should attempt to change, and no other. There is no need to consider individual type, when *individual* and *type* are antithetical.

The Impossibility of Normal Occlusion

For reasons other than the fact that the normal or ideal does not really exist and cannot exist in actuality, "normal occlusion" cannot be obtained in all cases of malocclusion. Reasonable proof is available to indicate that orthodontic therapy does not *develop* the structures concerned, namely, the maxilla and mandible, in a particular malocclusion. In 1940, after a joint appraisal of orthodontic results by means of cephalometric examination, Brodie¹¹ and his co-workers, stated that, "the most startling finding was an apparent

inability to alter anything beyond the alveolar process." The idea that the orthodontist can "grow" a chin by orthodontic means has long since been discarded.

It is quite evident that the basic etiology of some malocclusions may lie in faulty development of parts or perhaps malrelation of parts. (See Elsasser and Wylie.¹²) Therefore, on a purely logical basis the hypothesis of normal occlusion falls, since the first requisite of normal occlusion is the normal coordinated development of the structures concerned, in the establishment and maintenance of this condition.

Problem

Realizing the importance of esthetic consideration in orthodontic diagnosis and treatment, the problem of this investigation is to study the human profile and its relations to the skeletal and dental pattern of the individual. The examination was divided into three parts:

1. A study of what constitutes the present opinion of a "good" or "poor" profile.
2. An analysis of the underlying skeletal and dental pattern of selected "good" and "poor" profile outlines.
3. The application of these findings in orthodontic diagnosis of malocclusion.

Method

The method employed in this study was roentgenographic cephalometry. Each patient was subjected to lateral headfilms in rest and occlusion and a posteroanterior headfilm in occlusion at yearly intervals for two or more years. At the time of these appointments, lateral and frontal photographs were taken along with impressions of the teeth in alginate material for the construction of models.

Two groups of patients were ex-

amined: (1) children and adults possessing clinically normal occlusions and (2) cases of orthodontically corrected malocclusions. Numerous points, lines and angles were taken from tracings of the lateral headfilms similar to the method of Downs'¹³. Differences between bilateral landmarks, such as gonion, orbital, pterygomaxillary fissures, etc., were halved and midline points recorded. An effort was made to consider closely the various hard tissue landmarks that actually influence the human profile outline, including such points as nasion, anterior nasal spine, subspinale (Downs' point A), the most anterior point on the labial surface of the upper central incisor, the lower central incisor, supramentale (Downs' point B) pogonion, and gnathion. Several measurements were constructed to the most labial upper incisor for in the words of Angle, "it is the unnatural position in prominence of the upper teeth that cause the lower lip to protrude."⁹ A millimeter measurement of the distance from the middle of the incisal edge of the most labial incisor to the line from nasion to pogonion was taken to indicate the relation of incisor to face. Similarly a millimeter reading of the distance from the most labial incisor to a line drawn through point A and B was included as a measure of dental protrusion in relation to apical bases.

The angle A-N-B was included as a direct comparison of the relationship of denture bases to each other. Several other relationships of the most anterior points of the maxillary and mandibular apical bases were recorded, such as, AB to Frankfort-horizontal plane, line AB to occlusal plane, as well as the relation of the AB plane to the facial plane NP (See Downs').¹³ A complete listing of the points and angles measured can be found in a thesis on file in the Northwestern University Dental Library.¹⁴

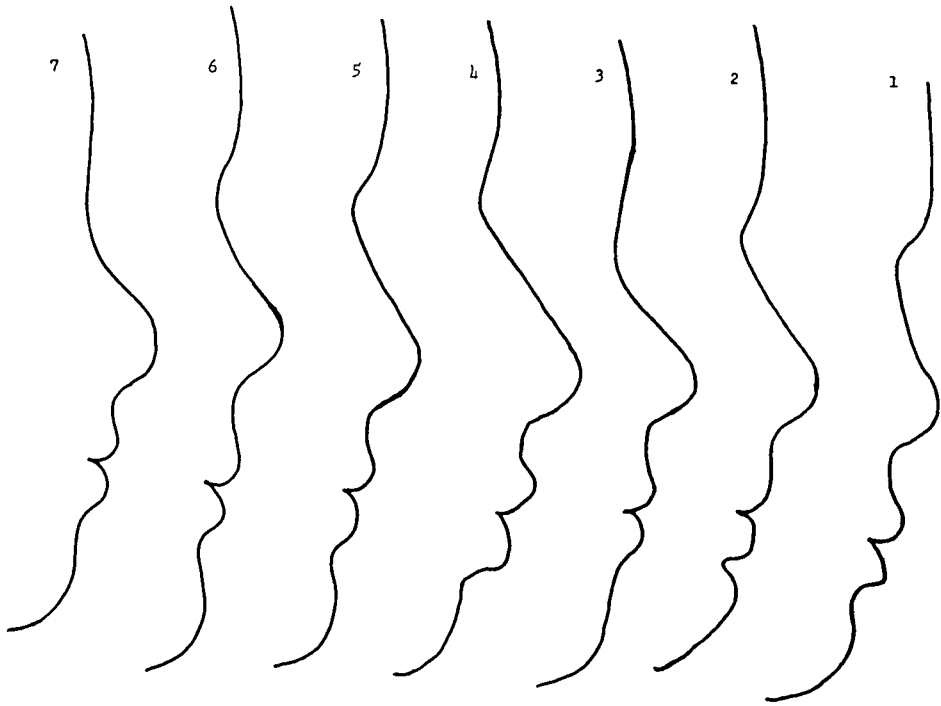


Fig. 1-A

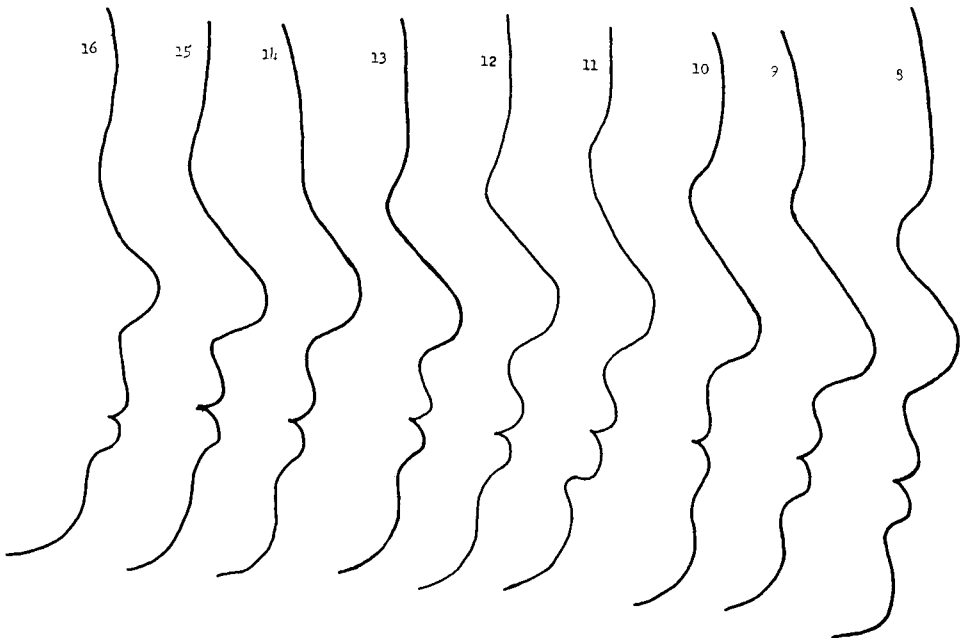


Fig. 1-B

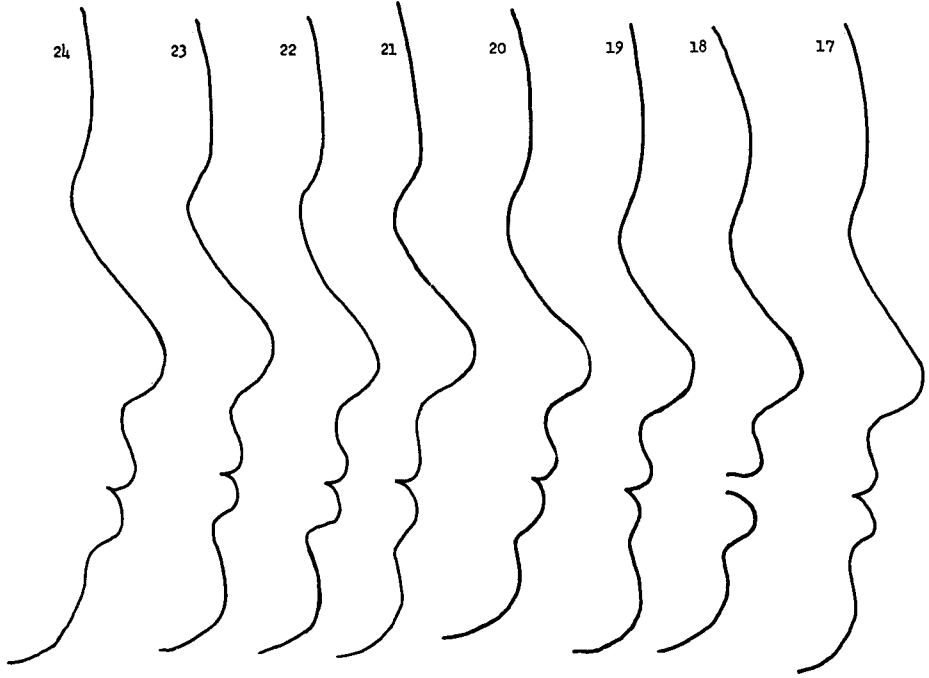


Fig. 1-O

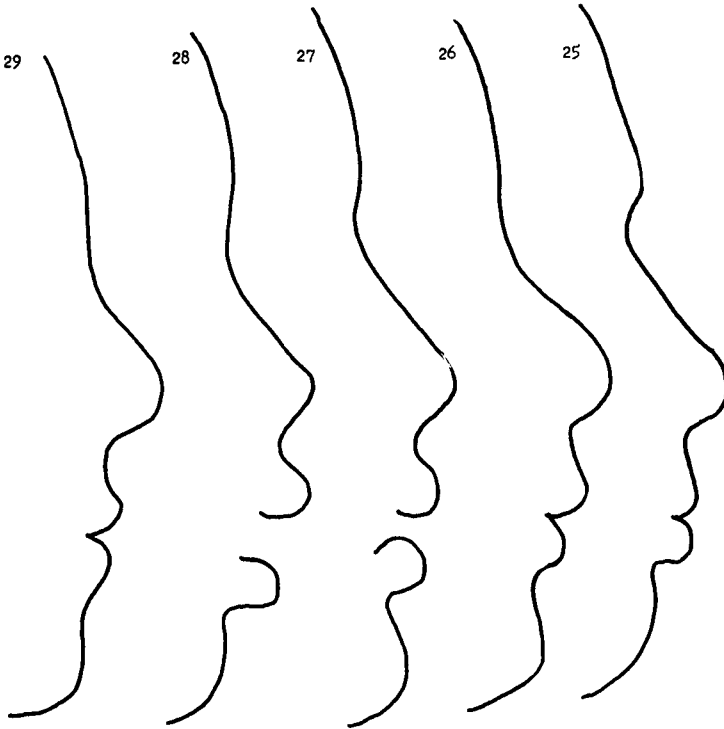


Fig. 1-D

Profile outlines of the soft tissue were constructed from the lateral occlusion headfilm, care having been taken to secure a relaxed relation of the lips when exposing the film. These profile outlines were submitted to several groups of orthodontists for consideration of their esthetic values.

Figures 1A-D show the actual outlines of the soft-tissue profiles of 24 children having normal occlusion in the mixed dentition stage ranging in age from 8 to 11 years. Profile outline number 25 was taken from a Class I malocclusion and outlines 26, 27 and 28 from Class II, Division 1 malocclusion cases. Outline number 29 was an exact duplicate of outline 14 and was used to determine the relative consistency of opinion of those judging the profiles.

Procedure

The profile outlines seen in figures 1 A-D were submitted first to 16 orthodontists connected with the Department of Orthodontics, Northwestern University Dental School. These men were asked to evaluate the profiles esthetically. The answers were as numerous as the profiles and investigators viewing them. "Protrusive", "poor facial balance", "good facial balance", "good or poor proportion", etc., and other adjectives were used to describe these outlines. Thus, it was decided to ask the individuals viewing the profiles to classify them as either "good" or "bad". This attempt met with failure because many opinions were reserved on a number of profiles where the critic was unable to make such a positive or negative decision. Hence, opinions were asked on a basis of "good", "fair", or "poor". It is evident, then, that the "fair" cases were those in

which the critics' opinions were more or less undecided. The objections to using a "good", "fair", or "poor" method of analysis are numerous and perturbing, but, as is the case with anything as ethereal as beauty, measurable methods are difficult and the emotion or feeling of the beholder defies analysis.

Later these same profiles were submitted to members of the Chicago Association of Orthodontists. In all, 72 opinions were gathered, all from practicing orthodontists. Thirteen profile outlines of adults having normal occlusion were included for consideration, but only two, A-3 and A-10, were included in this study as examples for comparison.

Data

Opinions were grouped according to the consistency of the critic viewing the profile. Table I, the first group, i.e., (No. 1) is composed of the opinions of 40 of the 54 individuals rendering opinions that were consistent in that profile outlines 14 and 29, which were duplicates, were judged alike. The other 14 of this group of 54 were inconsistent opinions. (Group No. 2), wherein profile outlines 14 and 29 were not consistently judged, one being judged good and the other fair. (Group No. 3) consists of 15 opinions wherein records were misplaced and it was not possible to check the consistency of the individuals judging the profiles. Of the 72 opinions submitted, only 3 were so inconsistent as to call profile outlines 14 and 29 either good and poor, or vice versa. The opinions of these three individuals were not included in the total opinion from which the results of this investigation were taken. Table I summarizes the opinions gathered.

TABLE I — SUMMARY OF POLLED OPINIONS

Profile Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Group No. I	P	P	U	P	G	G	U	U	G	U	P	U	U	G	
Group No. II	P	P	F	P	U	G	F	U	G	U	P	U	U	F	
Group No. III	U	P	U	P	G	U	F	U	G	U	P	U	U	G	
Poor	39	<u>56</u>	9	<u>63</u>	4	4	15	29	1	18	<u>62</u>	22	24	0	
Fair	24	<u>11</u>	40	<u>6</u>	23	19	<u>41</u>	25	21	26	<u>7</u>	32	30	21	
Good	6	2	20	0	<u>42</u>	<u>46</u>	<u>13</u>	14	47	25	0	15	15	<u>47</u>	
Total	U	P	U	P	<u>G</u>	<u>G</u>	F	U	G	U	P	U	U	<u>G</u>	
Profile Number	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Group No. I	P	P	U	P	U	F	U	U	U	P	P	U	P	P	G
Group No. II	P	P	U	P	U	U	G	U	U	P	P	U	P	P	G
Group No. III	P	P	G	P	G	G	G	F	G	P	P	P	P	P	G
Poor	48	<u>59</u>	7	42	4	18	3	11	6	<u>59</u>	<u>64</u>	34	<u>59</u>	68	0
Fair	<u>18</u>	<u>9</u>	23	<u>25</u>	23	35	23	37	29	<u>10</u>	<u>5</u>	25	<u>9</u>	<u>1</u>	23
Good	3	1	39	2	41	15	43	21	34	0	0	10	1	0	<u>46</u>
Total	P	P	U	P	<u>G</u>	U	<u>G</u>	U	U	P	P	U	P	P	<u>G</u>
Summary	7	Poor													
	11	Undecided													
	6	Good													
	—														
	24														

For the purpose of this investigation the profiles were classified as "good", "fair" or "poor" if 60% or more of the total number of opinions fell into one of these three groups. The profiles were held as *undecided* if none of these three classifications included 60% of the total opinions. It may be argued that 60% is little more than a majority opinion, but the results become almost startling when the "fair" opinions are momentarily discarded for what they really are (undecided opinions) and only the "good" and "poor" opinions examined. Thus, for profile No. 2 of the 58 "decided" opinions, 56 were poor and only 2 good, a 96.5% "poor" opinion. In profile No. 4, a 100% poor opinion is evident. In profile outline No. 5, a 91% "good" opinion, and so on. The overall consistency of opinion was surprising. It was also evident that fewer "fair" (or undecid-

ed) opinions were submitted on those profiles judged "poor" than on those judged "good". The opinion then, was in greater agreement as to what is *not good* than as to what is considered "good". To sum up the results of the opinion sample: Profile outlines 2, 4, 11, 15, 16, 18 and 24 (Fig. 2) were decided as being "poor" profiles. Profile outline numbers 5, 6, 9, 14, 19 and 21 (Fig. 3) were decided as being "good" profiles. The rest of the profiles could not be decided upon with the exception of profile outline number 7, which had over a 60% "fair" opinion.

Analysis

Each of the individuals from which soft-tissue outlines were taken was evaluated as to the relationships of numerous anatomical landmarks. Over thirty angular relations were measured on these thirteen headfilms, along with ten different millimeter measurements.¹⁴ The six "good" and seven "poor" cases were compared by inspection of the forty measurements taken from each

TABLE II — SUMMARY OF MEASUREMENTS SHOWING MARKED DIFFERENCE BETWEEN GOOD AND POOR PROFILES

		POOR PROFILES							
A	CASE NUMBER	2	4	11	15	16	18	24	A-3
N	A-N-B	5.5	7.0	3.0	2.0	2.0	4.0	7.0	4.0
G	U-1 - NP (Mm.)	8.5	10.5	9.0	7.0	8.5	7.0	12.5	9.0
L	U-1 - L-1	128.	129.	118.	127.	131.	122.	117.	131.
E	L-1 - OP	68.	72.	66.	72.	66.	67.	60.	66.
S	N-A-P	+10.0	+14.0	+4.5	+6.0	+5.0	+7.0	+15.5	+8.5

		GOOD PROFILES						
A	CASE NUMBER	5	6	9	14	19	21	A-10
N	A-N-B	2.5	2.0	1.0	1.5	-1.0	1.0	2.0
G	U-1 - NP (Mm.)	4.5	2.0	5.5	6.0	2.0	4.5	6.5
L	U-1 - L-1	147.	135.	132.	129.	143.	137.	125.
E	L-1 - OP	80.	72.	74.	72.	84.	79.	64.
S	N-A-P	+4.0	0.0	+1.5	+1.0	-3.5	0.0	+1.0

case. The figures obtained for each measurement in the group of "good" profiles were compared to the figures for that same measurement in the "poor" profiles. Table II shows the conclusive differences obtained in this study between the skeletal and dental patterns of individuals having good and poor profiles.

Differences

Angular relations such as Frankfort-mandibular plane angle, facial angle, and occlusal plane to Frankfort-horizontal plane revealed no particular differences between the two groups. Percentages of upper and lower face heights, of relation of cranial base length to maxillary length, etc., were also much alike in the two groups, individual variations being the only real difference.

The angle A-N-B in individuals having "good" profiles was as small or smaller in all cases than a similar angle obtained in individuals having "poor" profiles. In the "good" profiles the angle A-N-B did not exceed 2.5° . In the "poor" profiles all of the A-N-B angles exceeded 2° ; that is not to say that the range of the "good" profile apical base relations is between -1 and

and $+2$ degrees, the tendency, however, is plainly evident. Good apical base relations (i.e., those where the angle A-N-B is small) are part of good profiles. It is the *tendency* which is significant, not a mean figure for normal cases or an average for "good" profiles.

The linear measurement of Upper Incisor to NP expresses the relation of the incisor to the facial plane. It is evident that in the "poor" profiles the distance from upper incisor to facial plane is greater in all cases than the same measurement in "good" profiles. In "good" profiles this measurement did not exceed 6.5 millimeters. In the "poor" profiles this measurement always exceeded 7.0 millimeters.

The angular relation between the axial inclinations of upper and lower incisors is not one of the most conclusive angular relationships, but there is a very definite tendency for those incisors to be more upright in relation to each other in the "good" profiles.

The relation of the axial inclination of the lower incisor to a plane formed by the lower border of the mandible (L1 - GoGn) did not indicate an absolute difference between "good" and "poor" profiles although the tendency seemed to indicate that in the "good"

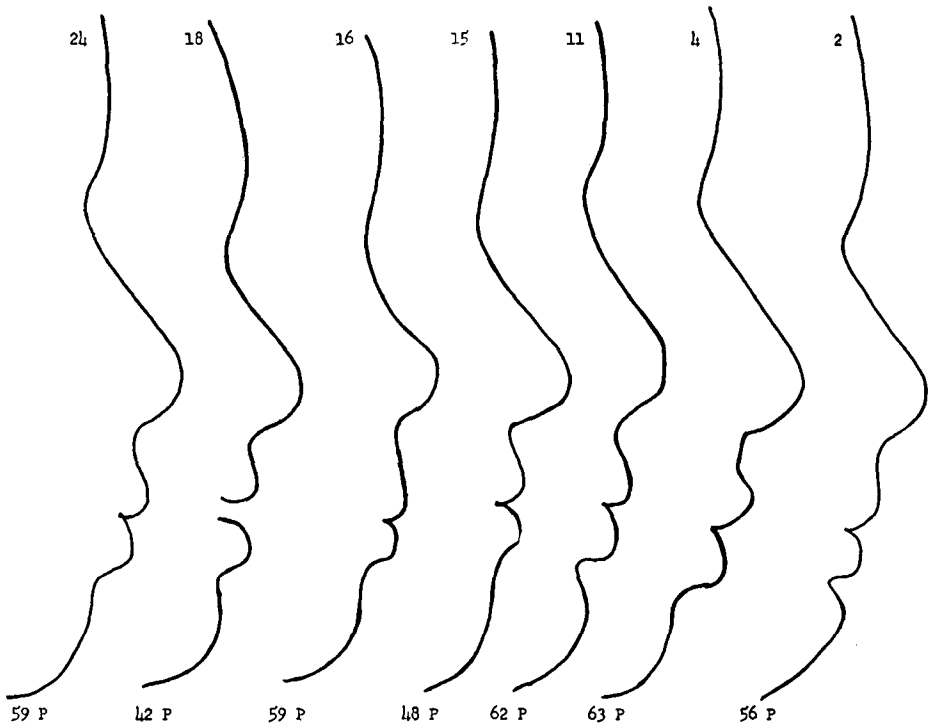


Fig. 2

profiles the lower incisors were more nearly upright. In four of the seven "good" profiles, however, the lower incisor was at more than a 90° angle to this mandibular plane, being 90, 93, 95 and 97 degrees. The relation of the axial inclination of the lower incisor to the occlusal plane revealed more accurately the tendency for the lower incisor to be upright. In the "good" profiles the angle formed by this lower incisor to the occlusal plane was not less than 72° . In the "poor" profiles the angle formed by the lower incisor to the occlusal plane was always less than 72° .

Examination of the angles of convexity (N-A-P) indicated quite clearly that the "poor" profiles were those with the more convex skeletal profile outlines. In the "good" profiles the angle of convexity (N-A-P) did not exceed

4.0° . In the "poor" profiles the angle of convexity was always in excess of 4.5° .

The following examples indicate that these findings were applicable in adult cases: A-10 was that of an adult possessing normal occlusion, where, out of 49 opinions, 41 were "good", 4 "fair" and 4 "poor". Case No. A-3 was that of an adult possessing normal occlusion where, of 50 opinions, 42 were "poor", 7 "fair" and 1 "good". These cases were included to show that what was true of children in the mixed dentition stage may also be true in regard to adult profiles.

Summary of profile investigations

In the two dimensions of space in which the human profile was examined from a lateral aspect, the evidence accumulated indicated that facial balance, harmony, or proportion are re-

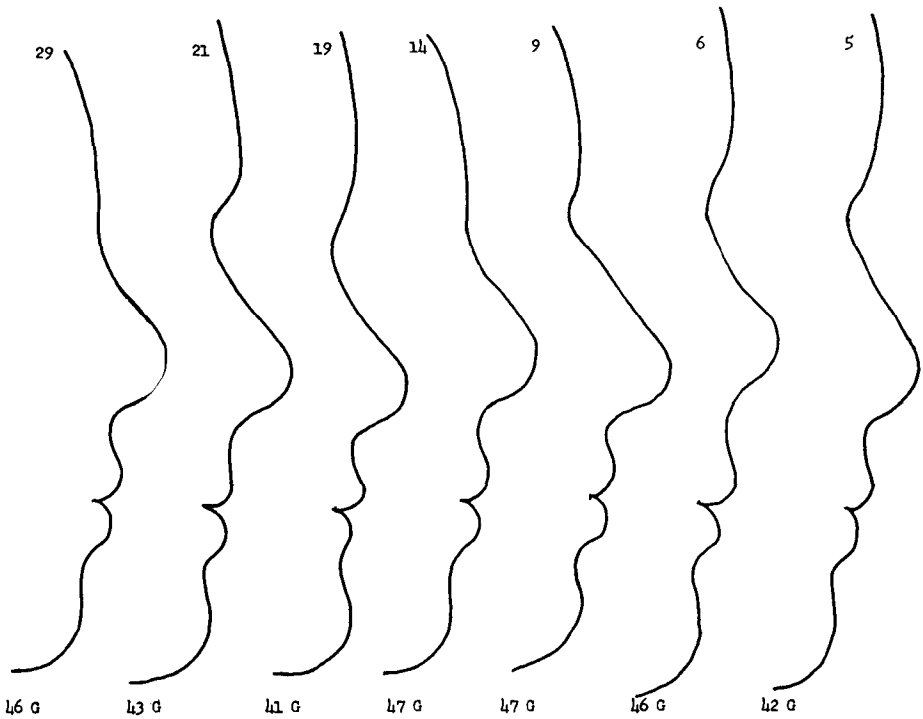


Fig. 3

lated in some degree at least to the underlying skeletal and dental pattern of the individual. Methods have been presented by means of which certain of the proportions contributing to well-balanced faces can be evaluated. The relation of the maxillary and mandibular apical bases in an anteroposterior dimension, the degree of the convexity of the skeletal pattern of the face, and the relation of the anterior teeth to the face and to their respective apical bases have a marked influence on the soft tissue profile outline.

Summary and Conclusion:

In summary then, it may be said that that various points which make up the hard tissue profile outline, i.e., points A, the upper incisor, the lower incisor and points B and P, bear harmonious relationship to each other in patients presenting "good" profiles. In

the correction of a particular malocclusion it should be the aim of the orthodontist to produce such facial balance or harmony as is possible within the limitations of the case. If it is not possible in a particular instance to reduce the angle of convexity or change the apical base relationship, then at least the orthodontist may reduce the protrusion of the teeth and it should be his aim to do so. In other instances, however, it may be evident to the orthodontist that no further reduction of dental protrusion should be attempted, and perhaps in some instances is to be completely avoided.

1. An attempt has been made to evaluate orthodontic opinion concerning soft tissue profile outlines. The opinions were remarkably uniform.

2. Common differences between individual profiles judges "good" or "poor" were found to exist in the

skeletal and dental patterns of these individuals.

3. Apical base relation, angle A-N-B, convexity of skeletal profile, angle N-A-P, position of upper incisors, U-1-NP mm, and angulation of lower incisors, L-1-OP, were found to be important in esthetic balance.

Generally speaking, the more convex the profile, the more upright must be the incisors to produce good facial balance, and conversely, if the skeletal profile is straight the incisors may be allowed greater procumbency in proportion.

Division of Health Sciences

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