Anchorage Considerations in the Treatment Of Class II, Division I Malocclusions

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There has been considerable discussion of mechanics and of anchorage in the treatment of Class II, Division I cases. While it is important to have an adequate understanding of anchorage to make the desired changes in tooth position, this must be coupled with a concept of the natural forces and changes which are also taking place. The fact that many similar results have been obtained with therapy that has varied considerably in fundamental philosophy would indicate that growth changes and adjustment of the facial structures and dental mechanism contribute in a large degree to orthodontic success or failure.

Class II, Division I malocclusions are associated with growth discrepancy, mandibular displacement or a combination of both. The mechanics used may be altered somewhat according to the requirements of treatment. The use of occipital force against the maxillary arch may be selected in cases of growth discrepancy to inhibit forward growth, and even to cause some retraction of the maxillary denture, while the mandible moves forward as the result of growth. Intermaxillary elastics may be employed in cases of mandibular displacement to assist in forward repositioning of the mandible, and also in cases where some forward movement of the mandibular denture on structure may be indicated.

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Some cases have inadequate structure to accommodate all the teeth in correct occlusion and will require extraction as a part of orthodontic treatment. In border line cases an attempt has been made to reposition all the mandibular teeth through the use of second order bends, occipital anchorage, and Class III mechanics into a position that has been considered to be one that offered greater anchorage potential. From this point on, the arch relation has been changed by intermaxillary elastics, and when indicated, by the addition of occipital anchorage against the maxillary arch. Some have carried out this method of repositioning the mandibular teeth in most of their Class II, Division I cases.

Limitations are imposed on treatment possibilities not only by maxillary and particularly mandibular structural inadequacy, but also by apical base difference. When this difference becomes too exaggerated, one must look to the possible presence of mandibular displacement as a means through which this difference may be decreased. In some instances, of course, it is necessary to extract the maxillary first bicuspids in order to reduce the discrepancy.

It is important to time treatment to coincide with growth accelerations. The use of serial cephalometric x-ray records will assist in determining when such accelerations are taking place. In general, growth is most active as the denture is being completed. Not only does this active growth assist in treatment, but in many instances it is important to retain the treated tooth

positions accurately until growth is completed and the teeth have worn into their functioning positions.

A wide divergence of opinion exists as to the requirements of occlusion and the method by which it shall be obtained. The use of occipital force against the maxillary arch with a very limited number of bands on the maxillary arch, and none on the mandibular teeth, would seem to ignore detail in individual tooth position and curve of Spee. This is also true where intermaxillary elastics are worn with a mandibular lingual arch or a labial arch with a limited number of bands. To those who set up mandibular anchorage with second order bends including the second permanent molars, credit should be given for all their determination and effort. While in some instances it may be indicated and beneficial, extreme execution of such treatment may be similar to a physician thinking that if a small dosage of strychnine is beneficial, increasing the dosage would be better.

Dr. Angle in his description of normal occlusion gave us a foundation which is fundamental and serves as an excellent guide for our work. Normal occlusion does not possess rotated teeth, exaggerated occlusal curves, or exaggerated axial positions of any of the teeth. Normal occlusion should be a precise position of teeth which permits occlusal surfaces to function harmoniously with the various movements of the temporomandibular joint. I can not conceive how any other relation can function in this way, whether it be from lack of detail in appliance therapy, or from exaggerated axial positions made so intentionally.

In the functional concept of development it was Dr. Angle's impression that if an ideal relation of teeth was established, and the patient were to function vigorously, it would stimulate the face to normal development. We, of course, are all familiar with the many studies which have, since Angle's time, been made on the growth of the human face. They have, to a large degree, disproved the functional concept of development. I do believe, however, that the functional concept has a place in our planning and thinking about distocclusion cases. When the mandibular arch particularly is corrected in arch form, curve of Spee, axial tooth positions and rotations, it frequently makes possible a rapid change in arch relation, which otherwise does not occur so readily. An accurate positioning of occlusal surfaces and the establishment of vigorous and normal forces seems to resist, to a large degree, tendencies toward relapse. While it is assumed generally today that such a detailed relation will not stimulate a face to optimum growth if the potential is not present, certainly, failure to obtain such an ideal relation can critically disturb function and can be a factor in relapse, as well as in failure to utilize all the potential which nature has supplied. We must accept the fact that we really do not know the effect of normal or abnormal muscular function on the growth of the facial skeleton.

The excellent paper, "*Appraisal of Orthodontic Results*," published by members of the faculty of the University of Illinois in the ANGLE ORTHODONTIST, October 1938, are familiar to all of us. The report served to reduce the optimism which most of us had in regard to our orthodontic results. It was pointed out the extent to which teeth would tip and, also, the degree of change in the occlusal plane with Class II elastics. The result of this investigation and many others, including those of Tweed and Oppenheim, is that we have become very conscious of the relation of the lower incisors to the mandibular plane and have taken great care

to maintain or develop what has been considered to be a stable relation during the treatment period.

A paper entitled *"Maintaining Mandibular Anchorage in Class II, Division I Treatment,"* published by the author in the ANGLE ORTHODONTIST, October 1949, described a method used by him in the treatment of Class II, Division I cases. Stated briefly, the following factors were considered to be important:

1. Starting treatment as the adult denture was being completed, which in many instances would be during a period of active growth.

2. Using a complete mandibular appliance with all teeth banded, starting with a round arch wire, and using an edgewise archwire before the application of Class II elastics.

3. The maxillary arch had a minimum number of bands, usually the six anterior teeth and the first permanent molars. A round archwire or a rectangular wire was used with an attempt to permit as much freedom of movement of individual teeth as possible.

While this approach would appear to give insufficient attention to mandibular anchorage, a large percentage of cases has responded favorably, and the results have been stable. An attempt has been made in this paper to analyze a group of eight cases which fundamentally were treated in this way. The Downs' analysis has been used in diagnosing the cases and in evaluating the changes resulting from treatment. An analysis was made of five of the cases some time after the conclusion of treatment. Intermaxillary elastics were used in six of the cases, extraoral force was used on one case, and a combination of extraoral force and intermaxillary elastics in one.

In making a cephalometric analysis one may arrive at erroneous conclusions very readily, just as in the interpretation of any other record. It seems necessary to make evaluations on the basis of the type of registration. The cases to be presented were oriented on the Frankfort plane, attempting to use a constant Frankfort. The Bolton triangle which appears on the composite tracings is from the original tracing. In some of the cases the triangle increased slightly in length as well as height. This is not recorded on the composite tracing. Any increase in vertical dimension above the Frankfort plane will not be recorded in the composites.

Growth changes which occur during treatment may readily make changes in record measurements so that faulty observations are made. If we wish to record a true picture of changes in tooth position, it is necessary to superimpose on the immediate area to be measured. To record the maxillary incisor it would be necessary to superimpose on the contour of the upper surface of the maxilla, since the anterior nasal spine is not always too reliable. The contour of the maxilla at the "A" point may change so that this surface can not be used. The mandibular incisor should be recorded by superimposing on the anterior portion of the mandible, making allowance for appositional growth. The relation of the mandibular incisors to the mandibular plane has been of particular interest in the cases to be discussed. While superimpositions of the immediate area have not been made for presentation, the relation has been checked carefully only to find that labial movement has been essentially zero.

Case Judy K. was a girl fifteen and one-half years of age with an atypical Class II, Division I malocclusion. The mandibular incisors had an abnormal path of attrition. The mandibular left cuspid and bicuspids were lingual to the maxillary teeth. The facial disturbance was not severe and the musculature was in reasonably good balance. The skeletal and denture measurements

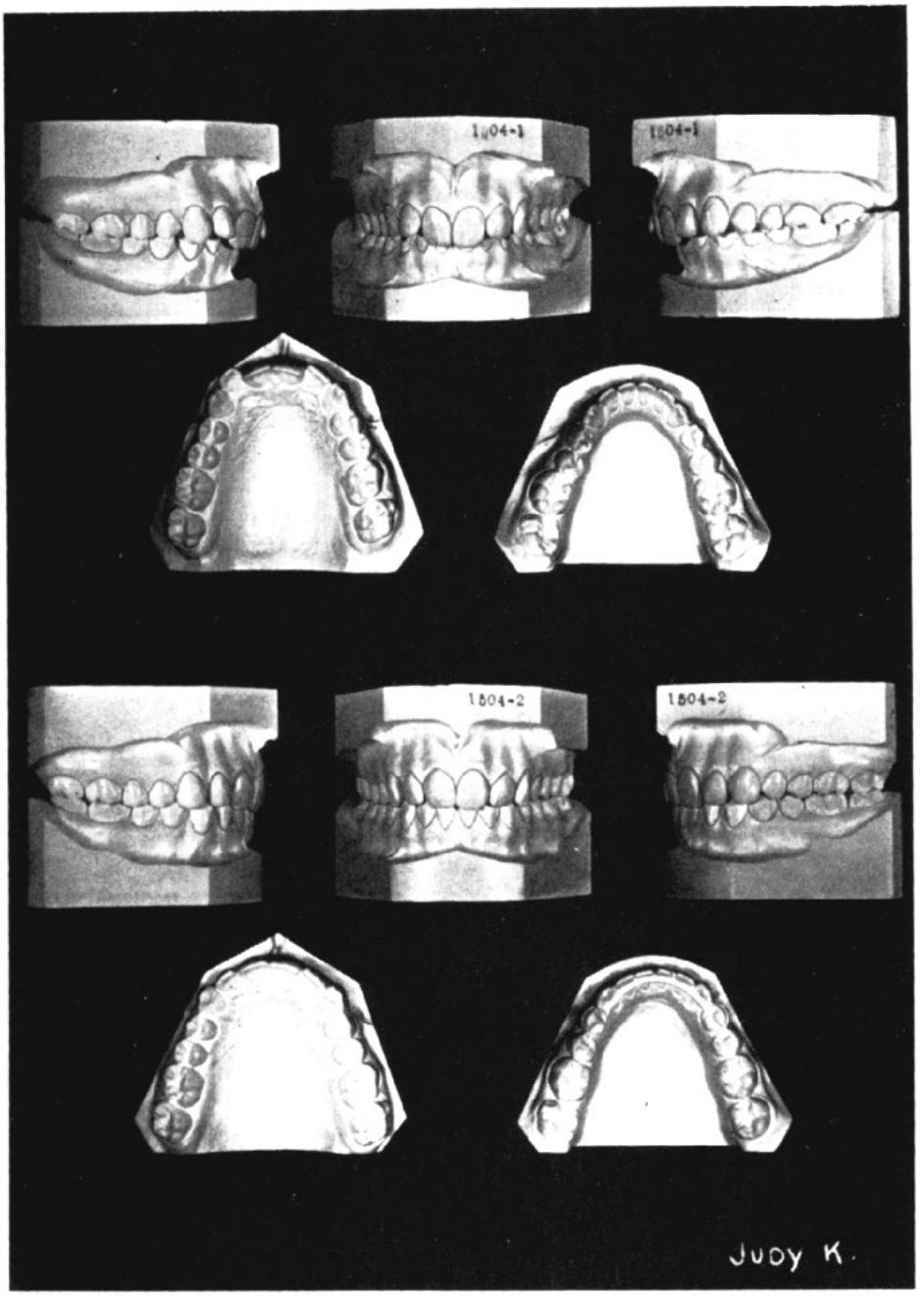

Fig. 1 Models of Judy K. before and after treatment.

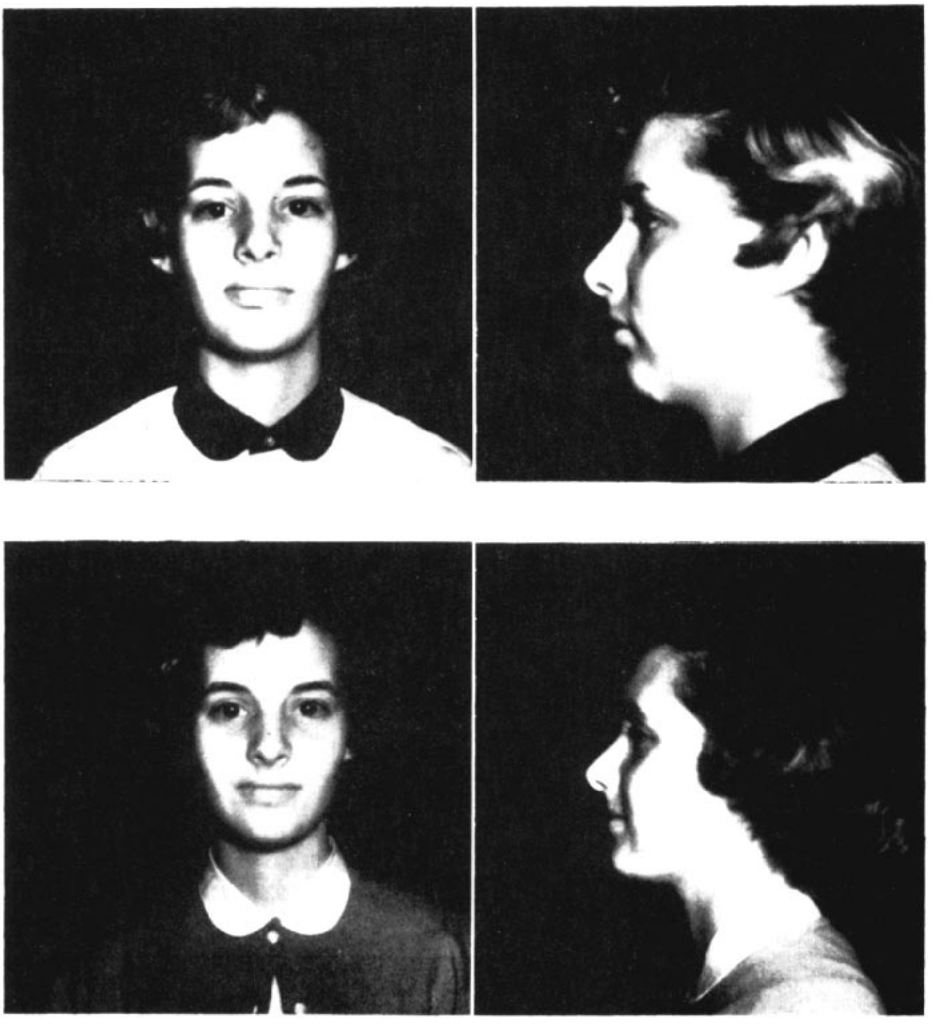

Fig. 2 Photographs of Judy K. before and after treatment.

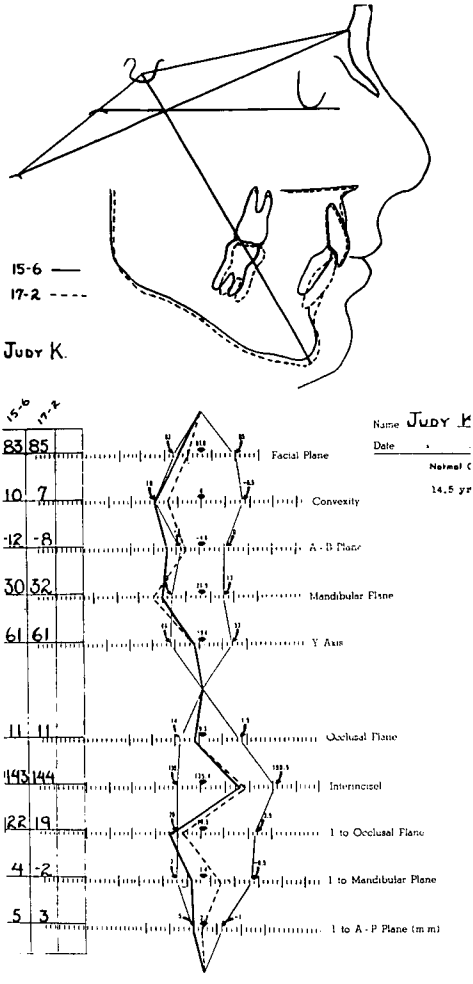

Fig 3 Tracings and graphs of Judy K. before and after treatment.

were essentially within the Downs' average measurements. This was classified as a functional malocclusion.

All the teeth were banded and edgewise archwires were used in both arches. Intermaxillary elastics were used for three months and active appliances were worn for eleven months.

The case has been retained with a mandibular fixed lingual arch from first bicuspid to first bicuspid. There has been no retainer on the maxillary arch.

There was a slight improvement in all the skeletal and denture measurements. Of particular interest is the stability exhibited by the occlusal plane and the mandibular incisors to the mandibular plane. The change in the occlusion has been due to mandibular repositioning. The case has exhibited excellent stability and the prognosis is favorable.

Case Carol Ann M. was a girl nine years and nine months of age with a typically appearing Class II, Division I malocclusion. The upper lip was quite short and lacking in function. The skeletal pattern was within the normal range except for the facial angle of 79 degrees and the slightly high mandibular plane of 29 degrees. The denture pattern was outside the normal range in the following respects: an extreme interincisal angle of 113 degrees, mandibular incisors to the occlusal plane 27 degrees and to the mandibular plane 10 degrees. The maxillary incisors were 13 millimeters in front of the AP plane.

This case was treated with edgewise appliances and edgewise archwires in both arches. Intermaxillary elastics were worn for two and one-half months. Active appliances were worn for fourteen months.

The mandibular arch has had no retainer. The maxillary arch has been retained with a Hawley bite plane.

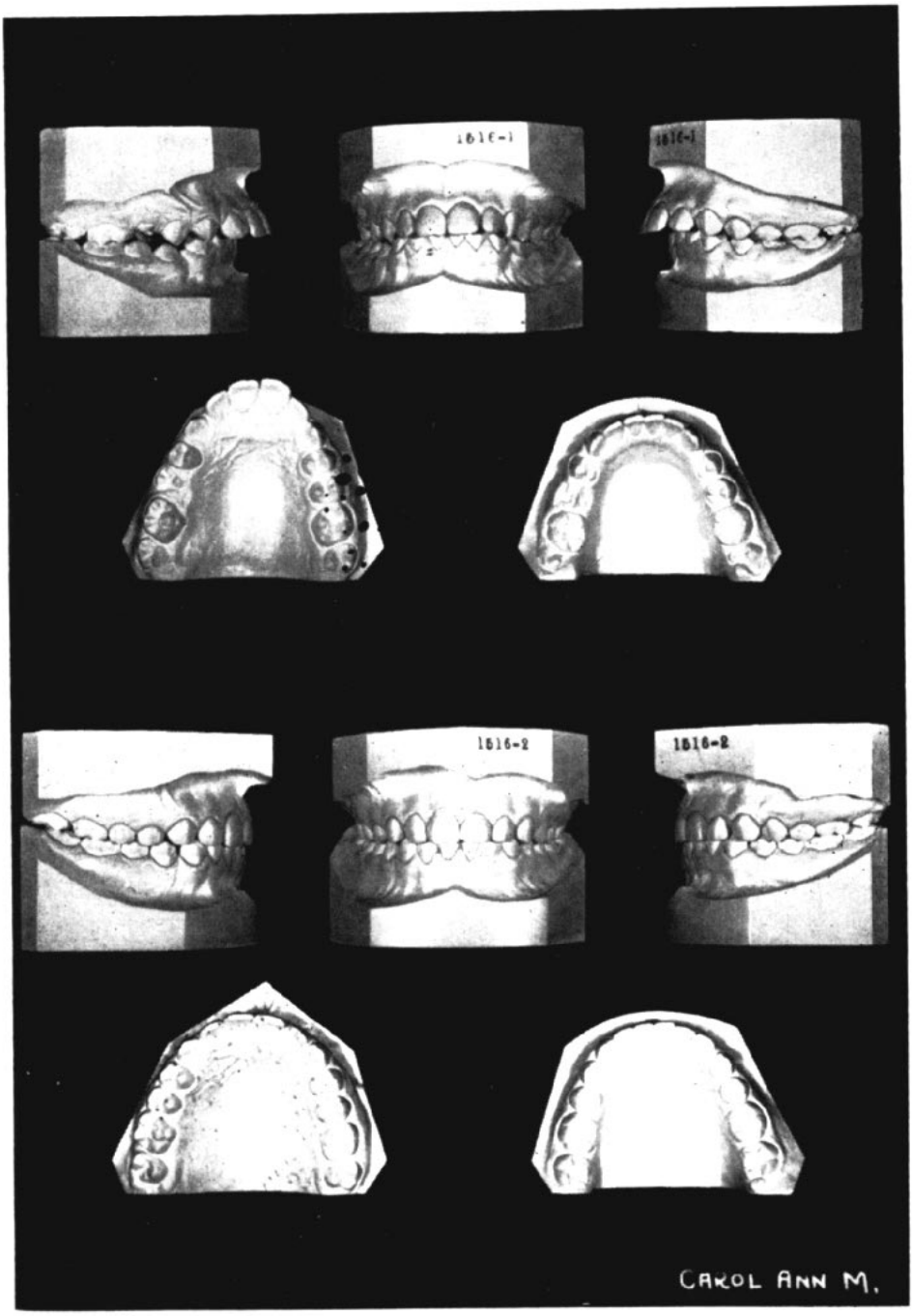

Fig. 4 Carol Ann M., models before and after treatment.

Fig. 5 Carol Ann M., photographs before and after treatment.

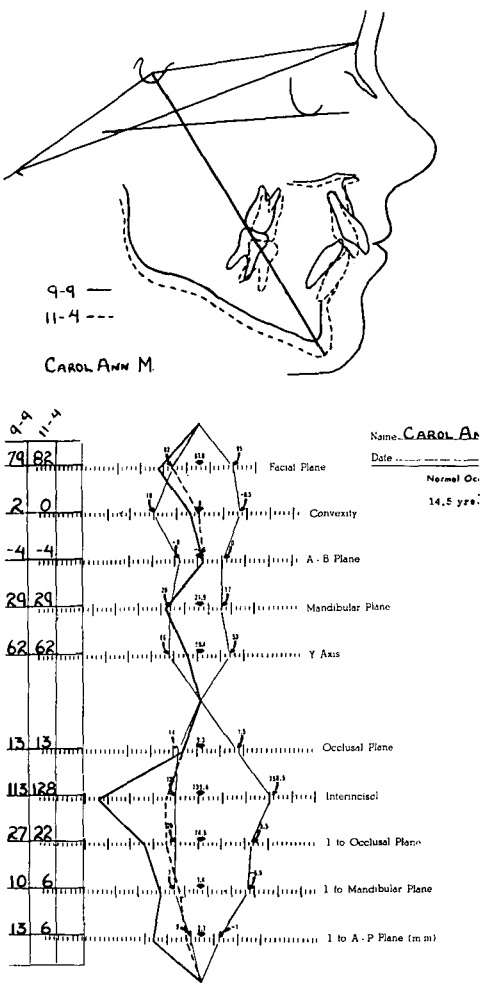

Fig. 6 Tracings and graphs of Carol Ann M. before and after treatment.

The skeletal pattern showed a slight improvement in the facial plane and angle of convexity. The denture was brought much closer to the normal range in every measurement. The occlusal plane remained the same.

The case has exhibited remarkable stability. The prognosis should be excellent. This patient had considerable growth during treatment. There may have also been some mandibular repositioning.

Katherine C. was a girl ten years of age with a Class II, Division I malocclusion.

Her face appeared very pleasing, with well developed musculature. The skeletal pattern was ideal, with every measurement falling approximately on the mean averages of Downs' analysis. The occlusal plane was ideal. The denture was protrusive to the face, with the maxillary and mandibular teeth inclined markedly to the labial.

Since the skeletal pattern was so ideal and the facial balance not disturbed to any extent, extraction was not considered necessary. The mandibular arch was started with a .021 steel archwire which was later changed to a rectangular archwire for the use of elastics. An .021 steel wire was used in the maxillary arch while elastics were used. Class II intermaxillary elastics were worn for three months. Total treatment time was eight months.

The mandibular arch has had no retention. The maxillary arch has been retained with a Hawley type retainer with a bite plane. The second set of casts was made nineteen months after the removal of active appliances.

As one would expect, there has been no change in the skeletal pattern. There has been some improvement in the denture relation, which shows some tendency toward relapse. The face has continued quite ideally in its growth.

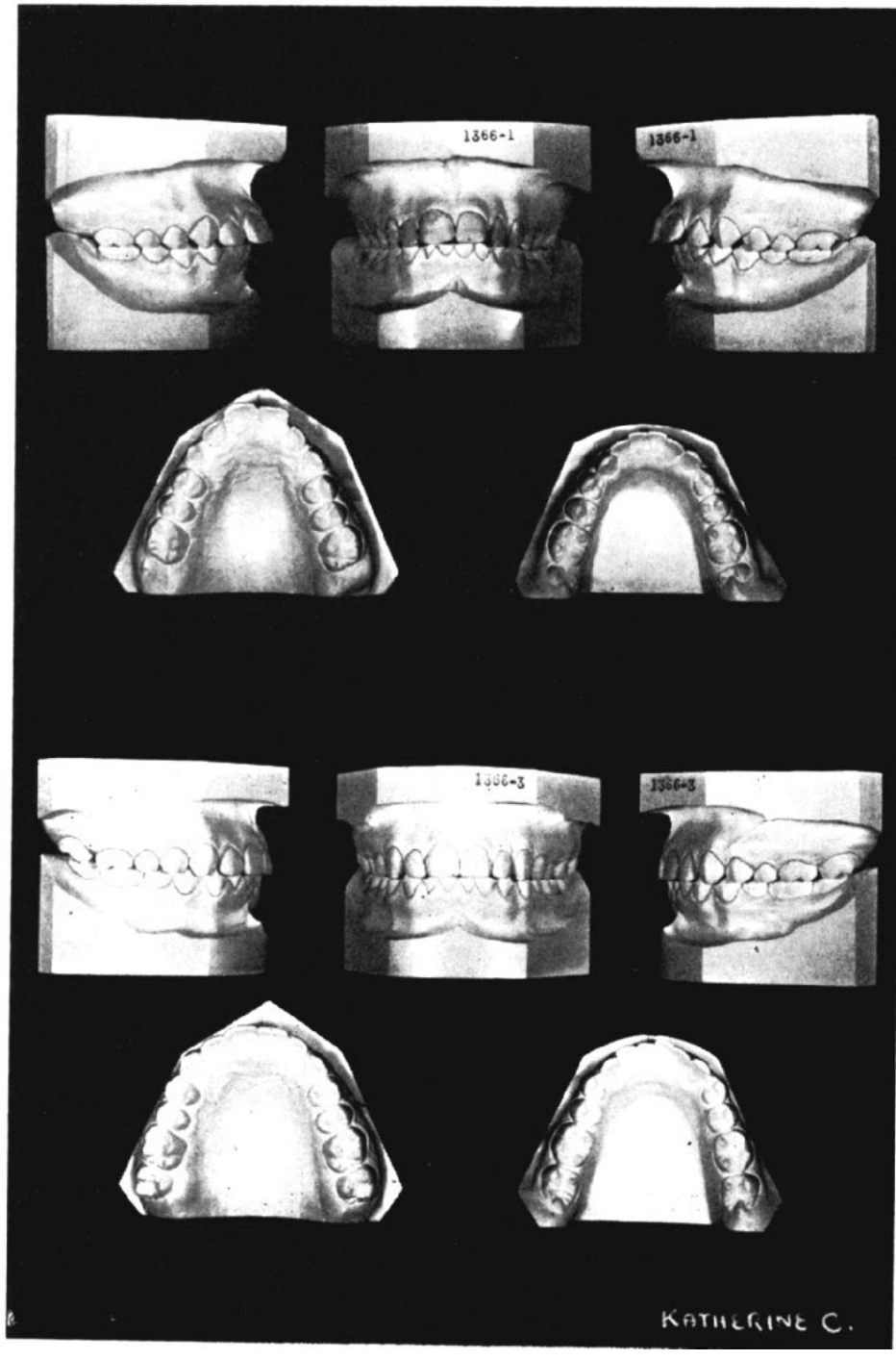

Fig. 7 Models of Katherine C. before treatment and two years and three months after treatment.

Fig. 8 Photographs of Katherine C. before and after treatment.

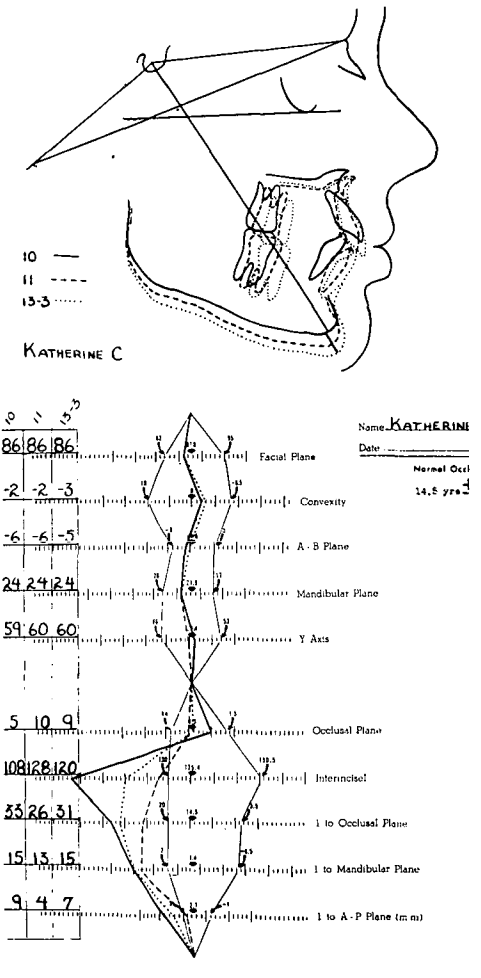

Fig. 9 Tracings and graphs of Katherine C. before and after treatment.

This case prompts one to comment about its relation to the Downs' analysis. While the denture does not conform, the skeletal pattern does.

The case treated easily and quickly, and exhibits stability to a large degree. The face and the positon and function of musculature are in what I consider a beautiful balance. While the averages given to us by Downs are an excellent guide and of inestimable value, they are taken from a group of normal relationships and they represent the same. This case gives one the impression that there are some individual normals that will not fall within the range of a group of normal averages or standards. We should not be too concerned if some treated cases do not conform to the measurements of a group provided they exhibit good function, stability and esthetics.

Karen R. was a girl eleven years of age with a Class II, Division I malocclusion.

Her skeletal pattern was within the normal range except for the mandibular plane of 34 degrees. The denture was in fair relation to structure with severe labial tipping of the maxillary incisors which were 13 millimeters anterior to the AP plane. The mandibular arch was in good relation.

This case was treated with routine Class II treatment, using an edgewise mandibular archwire and a round maxillary wire. Elastics were employed all the time for six weeks, then at night for four weeks. Later an elastic was worn intermittently on the right side. Active appliances were used for twenty two months. The case has been retained with a Hawley bite plane on the maxillary arch. There has been no mandibular retention.

No conspicuous change in skeletal pattern is evident. The denture has assumed quite a normal relation to struc-

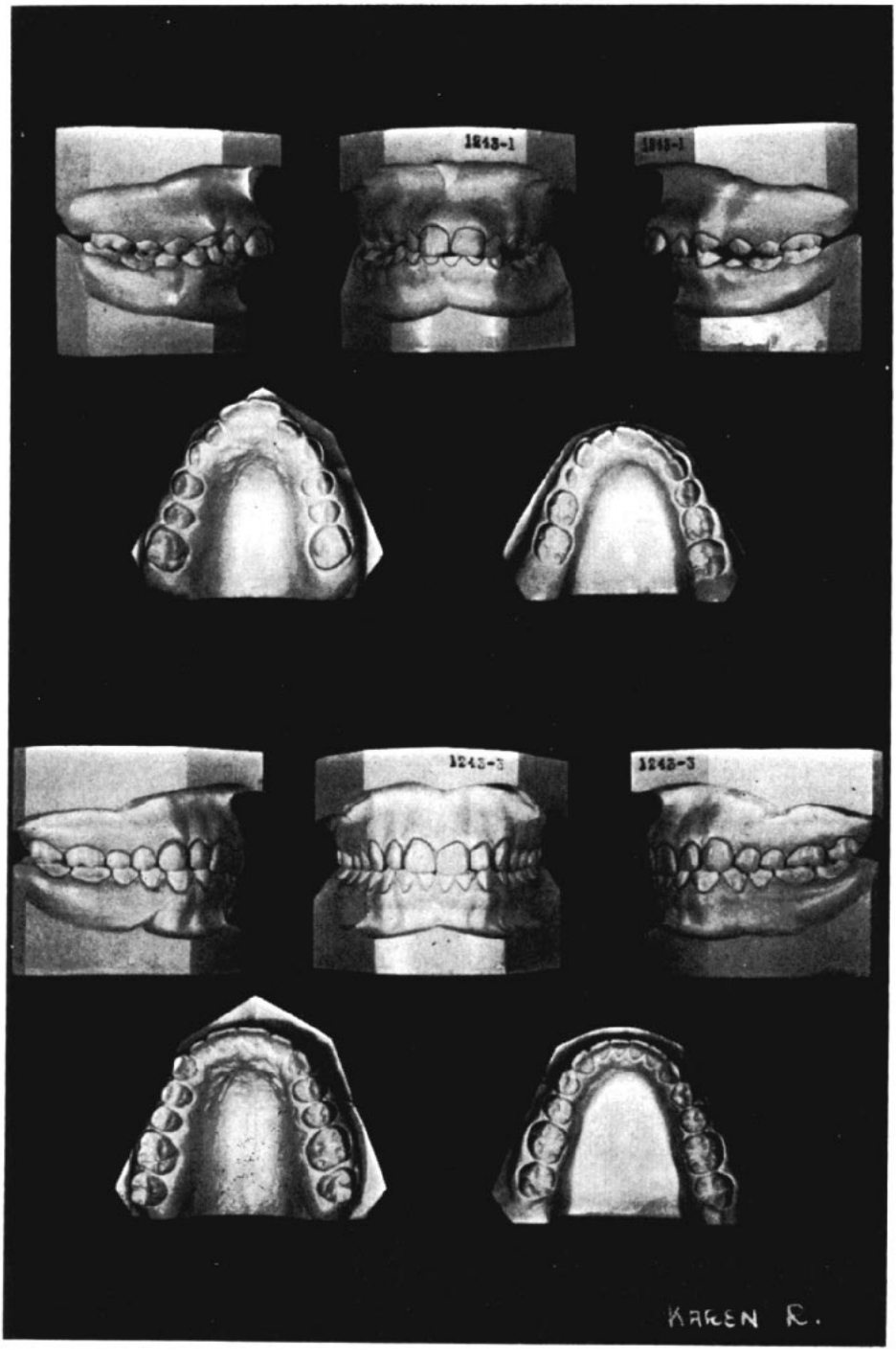

Fig. 10 Models of Karen R. before and after treatment.

Fig. 11 Photographs of Karen R. before and after treatment.

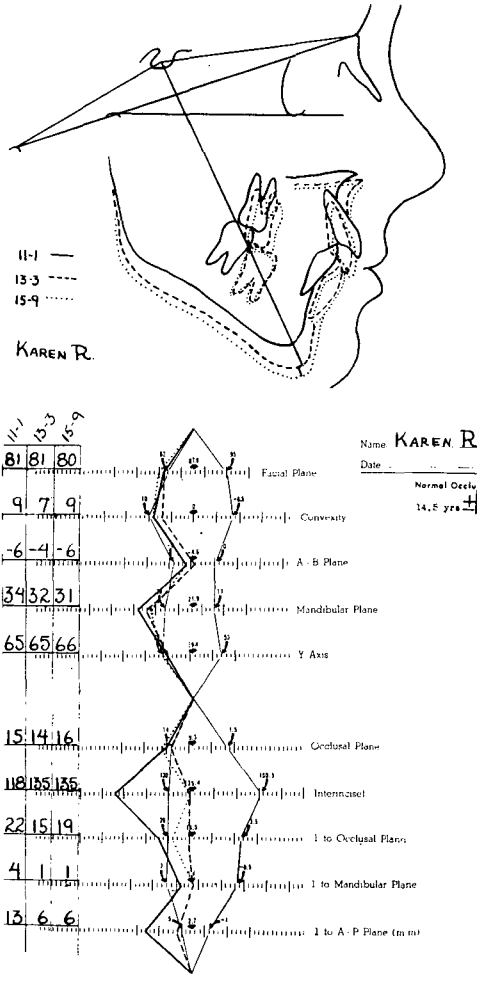

Fig. 12 Tracings and graphs of Karen R. before and after treatment.

ture and is very stable in its relation. The use of the bite plane has not resulted in any labial tipping of the mandibular incisors, as has occurred in some cases.

The very favorable change in denture relation and the marked stability exhibited are due largely to the splendid growth which has occurred, associated with good function.

Case Dennis M. was an eleven year old boy who had a severe Class II, Division I malocclusion.

His skeletal pattern was unfavorable in every way. It was the type of pattern from which one would expect nothing but trouble. The face did not look as unfavorable as the skeletal pattern would make one think it to be.

The denture was in poor relation to its supporting structures, except perhaps the mandibular incisors which were 2 degrees to the mandibular plane. Even this could not be considered as too secure when associated with the 41 degree mandibular plane.

In treatment intermaxillary elastics were worn for a total of nine months. Active treatment took sixteen months. The mandibular arch has had no retention. The maxillary arch has been retained with a Hawley bite plane.

During treatment there was an improvement in the angle of convexity and the AB plane. In the period since treatment there has been improvement in all parts of the skeletal pattern. The denture was brought within the normal range except for the occlusal plane, which was tipped up 2 degrees. The mandibular incisors were kept in their original position during treatment, but tipped labially 3 degrees in retention, probably from the effect of the incline plane. The maxillary incisors have been maintained in their relation to the AP plane.

In a case where one would least ex-

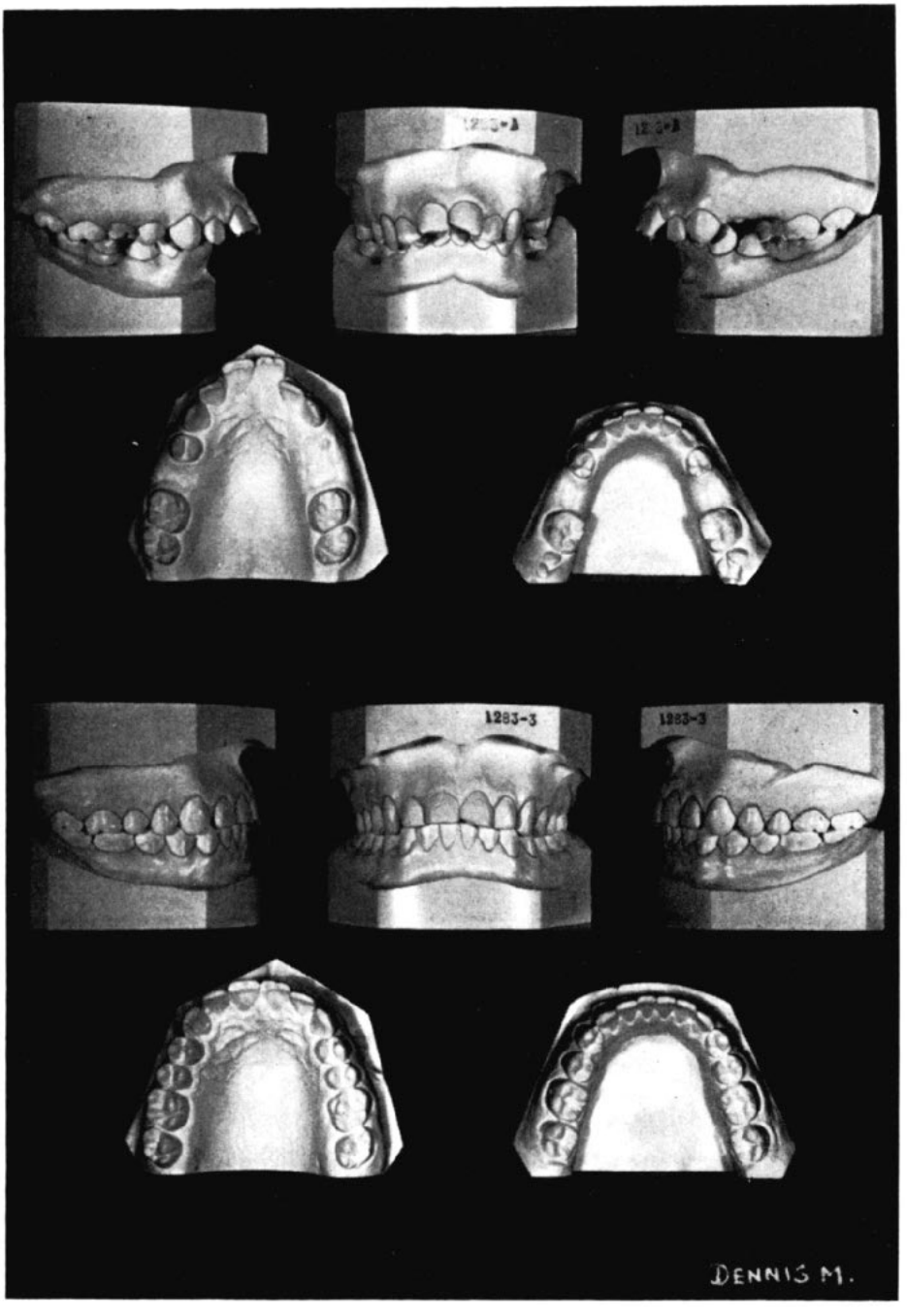

Fig. 13 Models of Dennis M. before and two years after treatment.

Fig. 14 Photographs of Dennis M. before and after treatment.

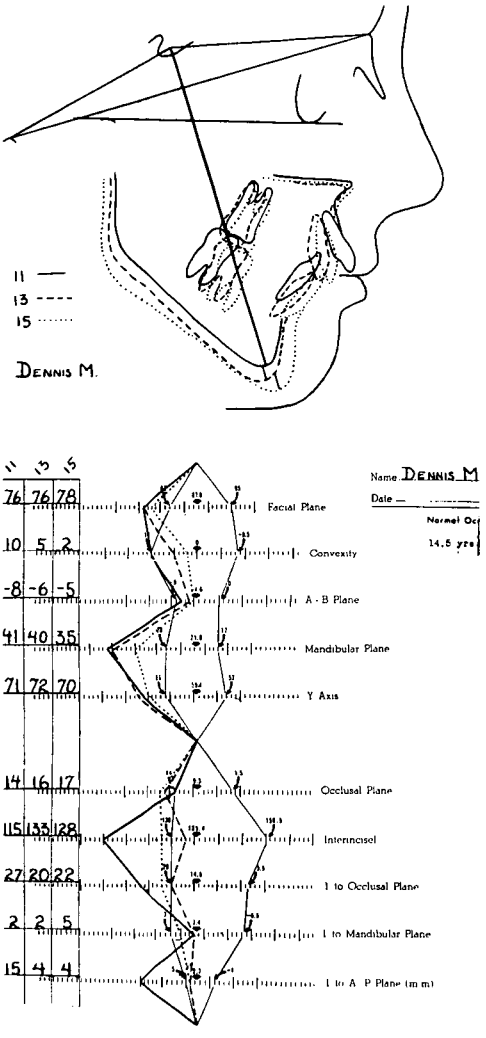

Fig. 15 Tracings and graphs of Dennis M. before and after treatment.

pect to see it, as judged by large deviations from the mean values, there has been a great amount of growth. From eleven to thirteen years both vertical and anterior growth took place. From thirteen to fifteen years, mandibular movement as a result of growth has been almost completely in an anterior direction. The amount of growth seems to be more important than its direction.

In a case like this it would be easy to extract upper first biscuspids and, by so doing, mutilate a denture which is accompanied by a skeletal pattern with considerable potential.

Jane C. was a girl twelve years of age who also had a Class II, Division I malocclusion.

The face exhibited extreme Class II tendencies; she had a short upper lip which functioned poorly.

Her skeletal pattern was poor; all the measurements were considerably outside the normal range. The denture relations were also outside the normal range, except for the mandibular incisors which were minus 3 degrees to the mandibular plane.

Edgewise appliances were constructed. Occipital force was used against the maxillary arch at night for thirteen months. Active appliances were worn for seventeen months. The mandibular arch has had no retention while the maxillary arch has been retained by a Hawley bite plane.

There was some improvement in the angle of convexity and the AB plane. The changes in denture relationships were favorable except for the occlusal plane which changed from 16 degrees to 20 degrees. One could question the actuality of this change because of the inaccuracy of recording the occlusal plane.

A cephalometric tracing made one year after the completion of treatment shows that the angle of convexity continues to improve and that other skele-

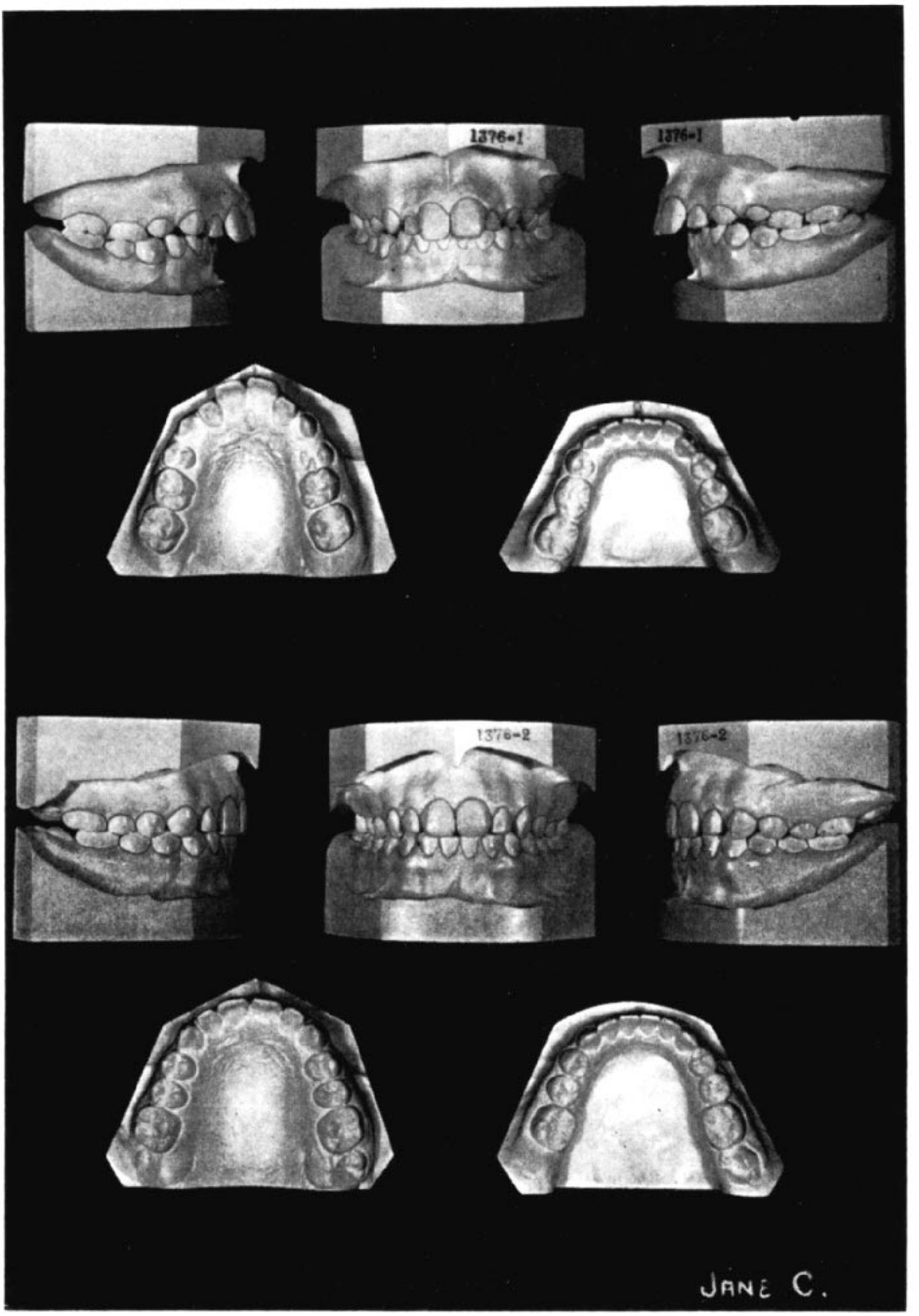

Fig. 16 Models of Jane C. before and after treatment.

Fig. 17 Photographs of Jane C. before and after treatment.

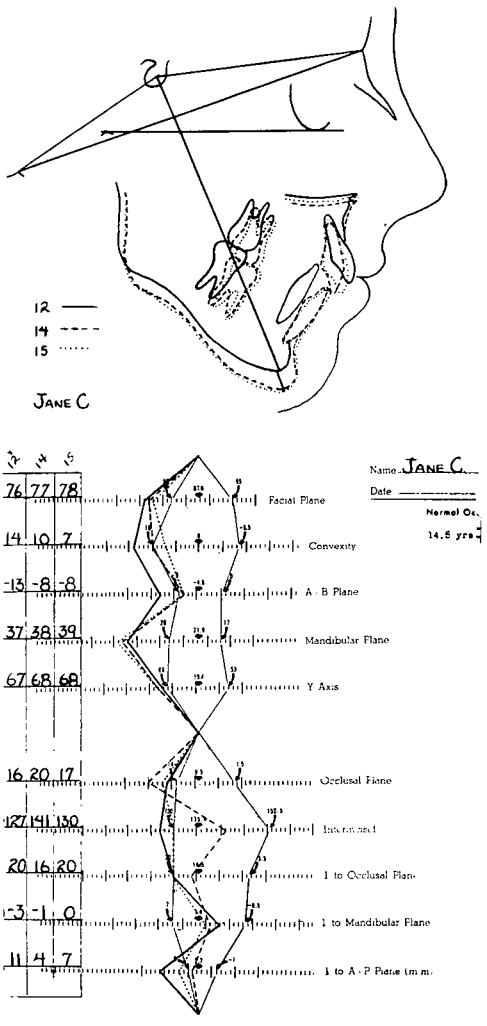

Fig. 18 Tracings and graphs of Jane C. before and after treatment.

tal changes are not sufficient to be significant. The denture relations have a conspicuous tendency to revert to the original.

There was considerable growth along the direction of the Y axis from twelve to fourteen years during the treatment period. There has been only a slight amount of growth since.

Occipital anchorage probably treated this case with as little disturbance to mandibular anchorage as possible. However, the lack of extensive growth in this case, particularly following treatment, and inadequate function contribute to instability. The prognosis is quite unfavorable.

Clark D. was a boy twelve years and four months of age, with a Class II, Division I malocclusion. The mandibular arch was crowded mildly in the incisor area, with the incisors inclined to the labial. The face had the appearance of protrusiveness in the denture area.

The angle of convexity and the AB plane were within normal averages. The facial plane, mandibular plane, and Y axis indicated a backward divergent face, with a moderately high mandibular plane.

Denture analysis indicated extreme labial inclination of both maxillary and mandibular incisors. The maxillary incisors were 15 millimeters anterior to the AP plane. There was a moderately high occlusal plane angle. The labial inclination and forward position of the incisors did not fit into his skeletal pattern with its low angle of convexity and low AB angle. It would seem quite futile to attempt early treatment of such a case with occipital anchorage.

Four first bicuspids were extracted as part of treatment. After the spaces were closed intermaxillary elastics were employed for four months. Active appliances were worn for seventeen months. The case has been retained with a cus-

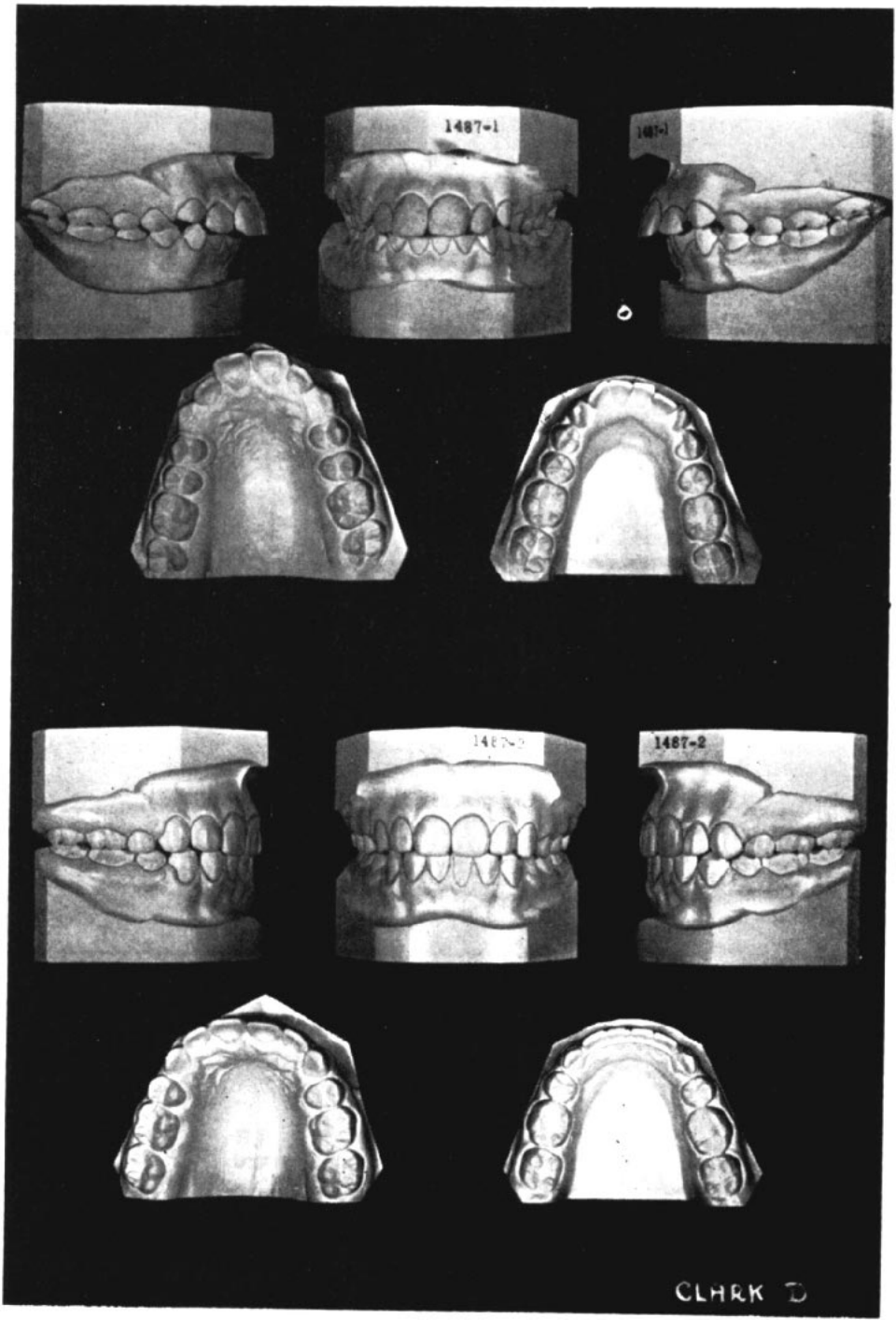

Fig. 19 Models of Clark D. before and after treatment.

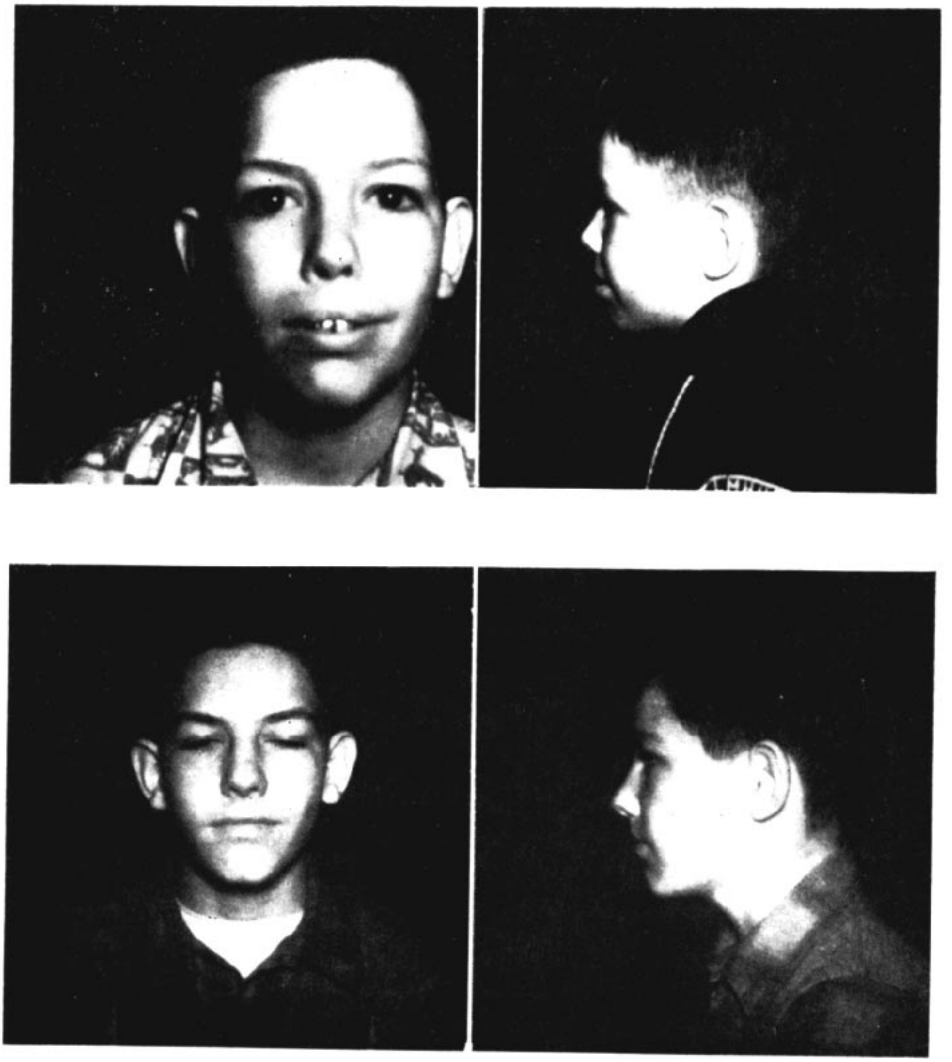

Fig. 20 Photographs of Clark D. before and after treatment.

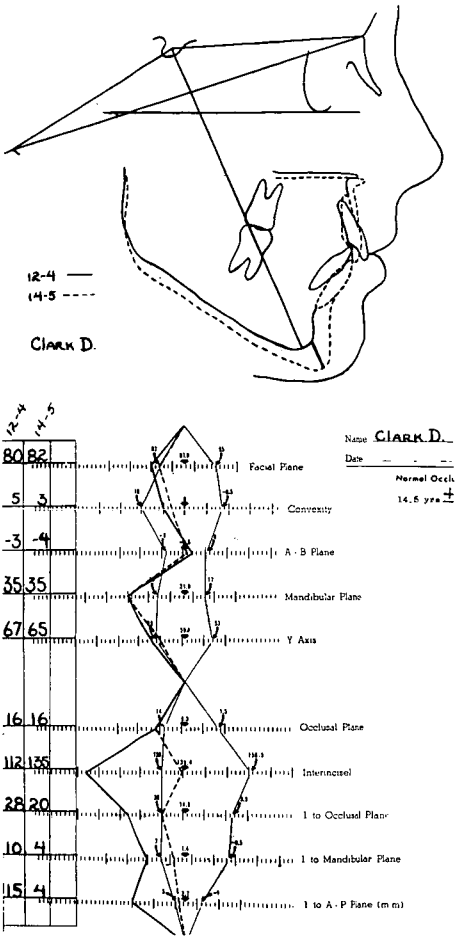

Fig. 21 Tracings and graphs of Clark D. before and after treatment.

pid to cuspid fixed mandibular retainer and a Hawley retainer in the maxillary arch.

There has been only a slight improvement in the skeletal pattern. The denture has been brought essentially to within a normal relation to structure.

The occlusion of the tooth surfaces is not too satisfactory. It is perhaps an example of the result obtainable in some extraction cases. The distribution of tooth material resulting after extraction makes it most difficult to obtain a perfect occlusal relation.

Case Mary Lee M. was a girl eleven years of age with a Class II, Division I malocclusion. The denture was protrusive to structure with maxillary and mandibular incisors inclined to the labial and with crowding of the mandibular incisors. The maxillary second bicuspids were congenitally missing.

The face was prominent in the denture area, with the lips under tension when closed.

Her skeletal pattern was essentially within normal range, with a moderately high angle of convexity, high AB and mandibular planes.

The maxillary incisors were 11 millimeters in front of the AP plane. The mandibular incisors were 6 degrees to the mandibular plane, and 28 degrees to the occlusal plane. The interincisal angle was 122 degrees.

The case history revealed that she had previous treatment with an occipital appliance, starting at nine years of age. This case is similar to the previous case in that treatment with occipital anchorage in the mixed dentition period was not indicated considering the degree of discrepancy.

The mandibular first bicuspids and the maxillary second deciduous molars were extracted. During treatment both occipital anchorage and intermaxillary elastics were worn for nine months. Appliances were utilized for fourteen

Fig. 22 Models of Mary Lee M. before and after treatment.

Fig. 23 Photographs of Mary Lee M. before and after treatment.

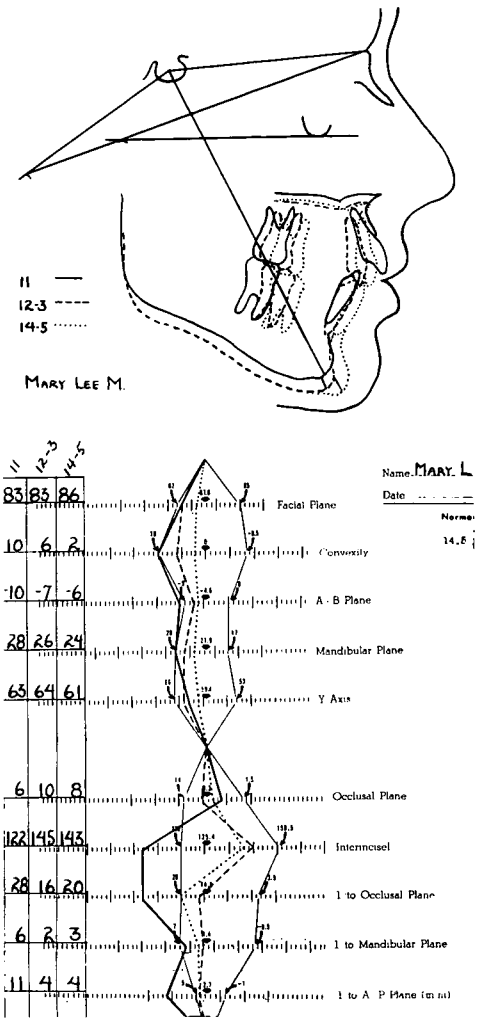

Fig. 24 Tracings and graphs of Mary Lee M. before and after treatment.

months.

The case has been retained with a Hawley retainer. The mandibular arch has had no retention.

There were favorable changes in the skeletal relationships which have continued to show improvement in the two years post-treatment period. The denture was brought well within the normal range and has stayed very close to the same relation in the post-treatment period. The second set of casts gives the impression that the maxillary incisors are being held back too far. I believe the function would improve if this case had no retention.

In general there were not too many significant changes in the skeletal patterns. For the most part they continued in the same overall direction of growth. Table one is a tabulation of denture changes.

In the first three cases, judged to be mandibular displacements, there was no change in the occlusal plane. This was also true of the extraction case Clark D., and Karen R., in which elastics were worn for two months only. In the remainder of the cases, the plane changed from 2 degrees to as much as 5 degrees. There seemed to be no relation between the length of time elastics were worn and the extent of the tipping. I do not think one should conclude there could be no relationship just because it is not apparent in the analyses of these cases. It has been demonstrated that a relation does exist. It is also undoubtedly related to the force of elastics and to the extent of growth and adjustment in tissue relations. The two cases in which occipital anchorage was used had a change of 4 degrees each. The direction of force from the occipital anchorage may have been partly responsible.

There was a consistent decrease in the angle of the mandibular incisors to the occlusal plane except in the first case, where displacement seemed ob-

PATIENT	Age	Occl. Plane			⌐1 to Occl. Plane			⌐1 to Man. Plane			Interincisal			⌐1 to AP Plane (In Millimeters)			E=Int. Max. Elastics O=Occipital Force
Judy K.	15-6	11	11		22	29		4	-2		143	144		5	3		E 3 Mos.
Carol Ann M.	9-9	13	13		27	22		10	6		113	128		13	6		E 2½ Mos.
Katherine C.	10	5	10	9	33	26	31	15	13	15	108	128	120	9	4	7	E 3 Mos.
Karen R.	11	15	14	16	22	15	19	4	1	1	118	135	135	13	6	6	E 2 Mos.
Dennis M.	11	14	16	17	27	20	22.5	2	2	5	115	133	128	15	4	4.5	E 9 Mos.
Jane C.	12	16	20	17	20	16	20	-3	-1	0	127	141	130	11	4	7	O 13 Mos.
Clark D. (Extraction)	12-4	16	16		28	20		10	4		112	135		15	4		E 4 Mos.
Mary Lee M. (Extraction)	11	6	10	8	28	16	20	6	2	3	122	145	143	11	4	4	O+E 9 Mos.

vious. She was the oldest patient in the group.

It should be restated that the method of registering the occlusal plane is so inaccurate that it is impossible to make any interpretation from small changes recorded in its relation to teeth or to other more fixed structures. The molars used in registering the plane are lateral points in the face which change considerably with any deviation in head position. The plane itself may also be changed in form with treatment, so that a different plane may be registered at the conclusion of treatment to the one used at the beginning.

The mandibular incisor to mandibular plane angle was reduced from 1 to 6 degrees. The maximum reduction occurred in two cases, one extraction case, and one non-extraction. The incisors tipped labially 2 degrees in case Jane C. and 1 degree more in retention. This is the case in which occipital anchorage was used. It probably occurred because of the lingual position originally of —3 degrees. The use of an edgewise archwire could also cause such a change. There seemed to be a tendency for teeth to tip labially to a small degree in the posttreatment period, perhaps from the action of the bite plane.

There was a tendency for the interincisal angle to decrease again following treatment, and for the maxillary incisors to move forward in relation to the AP plane. Sufficient retention has been used during the period so that these figures do not represent the true result of natural forces.

Discussion

From the analyses of these cases the following deductions may be made.

1. Changes in the correction of Class II, Division I malocclusions are dependent upon the degree of change in mandibular position and the amount of mandibular growth.

2. Functional distocclusions may be corrected satisfactorily after the patients have completed most, if not all, of their growth, and without adverse changes in the relation of mandibular teeth to supporting structure.

3. The use of intermaxillary elastics does not seem to disturb the relation of mandibular teeth to their base, *provided light forces are used,* and there is either a change in mandibular position or sufficient growth occurrence during the treatment period.

4. The method used in determining the occlusal plane permits sufficient variation in its registration so that observations concerning changes in the plane may have a high degree of inaccuracy. From the data recorded, however, it would seem as though extraoral force consistently caused a greater tipping of the occlusal plane than did intermaxillary elastics. This observation would not necessarily be true in all cases. The direction of force was undoubtedly the

cause for the change in these cases.

5. Mandibular incisors may be kept in their original relation to the mandibular plane with the use of intermaxillary elastics. They may be tipped labially by the use of an incline plane on a Hawley retainer during the retention period.

6. Patients behave as individuals with their own variations of growth and relationships. Many conform to measurements of groups of normals. The skeletal patterns of some do not conform, but still possess an adequate growth potential with which the denture relation can be made acceptable. Some have a skeletal pattern which does not conform to normal standards of measurement and is also lacking in growth potential. Most of these cases require sacrifice of tooth material to bring the denture into a stable relation to structure.

It seems advisable to obtain complete control of the mandibular teeth in Class II, Division I cases in order to obtain a dental arrangement that is as ideal as possible in every detail and which will provide sufficient resistance to forward movement on structure. Allowing the maxillary teeth to move individually as much as possible permits them to move into functioning positions as the malrelations are corrected.

We can design our anchorage and select the time for treatment that should be the most favorable. The success of our approach will depend largely upon the growth and adjustment which takes place.

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