Appraisal of Results of Surgical Correction of Class III Malocclusions*

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Introduction

Mandibular prognathism or Class III malocclusion (Angle) has long been looked upon as one of the most severe facial deformities. Many patients afflicted with the condition have signified a willingness to face possible death rather than continue to live thus deformed. It is not surprising therefore to find early reports of surgical efforts directed toward its alleviation.

In 1848 Hullihen performed a pioneer operation on a prognathic jaw and shortly thereafter others undertook similar operations. The results claimed, varied from good to complete loss of the mandible. It was not until 1898 that the first outstandingly successful operation was performed. This was done by Blair, and it consisted of a resection of the body of the mandible in the bicuspid region with subsequent interdental wiring. This operation of course severed the mandibular blood and nerve supply, both procedures that are fraught with great danger.

Babcock in 1910, first reported surgical correction by horizontal sectioning of the ramus and since that time this technique has been embraced by many others. Certain European authors have advocated sectioning of the neck of the condyle. In operations involving the ramus above the mandibular foramen there is, of course, less danger of damage to the blood and nerve supply.

In 1926 Schultz and Willet reported a case in which they employed the original Hullihen method, i.e. resectioning of the body, and of recent years this method has been advocated by Dingman, who has refined it further. Making it a two-step operation he first removes the necessary amount of bone structure above the mandibular canal by an intra-oral operation and subsequently removes the bone below the canal by an extra-oral approach. This avoids injury to the mandibular vessels and nerves.

With the spectacular success attained with other jaw conditions through orthodontic management, it was but natural that such techniques should be employed in the handling of Class III cases, and with the turn of the century there was apparently a tendency for men to turn to such measures in place of the hazardous surgical procedures. However, the treatment of mandibular prognathism by orthodontic means was not attended with outstanding success, although this fact was either not realized or at least not acknowledged until 1938. In that year the orthodontic staff at the University of Illinois reported a "Cephalometric Appraisal of Orthodontic Results", which proved that actual bone changes accompanying orthodontic treatment were restricted to the alveolar process. The adult Class III cases, although successful as far as maintenance of occlusal relationships, were not markedly improved esthetically.

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Of recent date there seems to have been a realization on the part of both surgeon and orthodontist, that the successful management of mandibular prognathism calls for cooperation between them. The orthodontist although realizing his ability to move the teeth, acknowledges his inability to improve the balance of the face; while the surgeon fears for the ultimate success of his operation unless the patient can be provided with an efficient occlusion to which he can be shifted at the time of the operation.

One of the earliest reports of orthodontic treatment in preparation for surgical intervention was made by Linberg. In discussing the treatment of open bite by osteotomy (1925) he stated, "Before an operation on the mandible for the correction of the occlusion is performed. it is often necessary to treat the patient first by orthodontic means. The correction of the ooclusion, checked by means of plaster models, must be obtained beforehand."

Although several good case reports have appeared in the literature since 1940, (Schaefer 1941; Weiss et al 1941) most of them are characterized by a lack of complete records and few have included follow-up records. This report was prepared in order to present a series of cases that have been observed for a sufficient period of time to permit a statement of ultimate success or failure.

Combined Orthodontic-Surgical Management of Class III Malocclusion

It is not the premise of this paper to discuss the surgical aspects involved in the treatment of these cases except to point out the type of operation performed. Our concern will be with the role of the orthodontist in the pre- and post-operative care of the patient. Here he plays the important part.

The first step is the taking of complete records for study and consultation with the surgeon. These should include:

1. Good impressions of both jaws with wax bite for registration.
2. Lateral head X-rays taken at sufficient target distance, to insure a minimum of enlargement (5 feet) and oriented carefully to give good superpositioning of right and left side. In addition lateral jaw X-rays are frequently helpful for the delineation of detail of the two rami.
3. Complete intra-oral X-rays for the determination of adequacy of anchorage.
4. Photographs - frontal and lateral.

The next step is the study of the records. For this purpose the casts should be mounted in any articulator that will permit an anteroposterior shifting of one of the casts in relation to the other. When this is done the effort is made to reposition the casts in the relation that is to be sought by the operation. (Fig. 1) In doing this, careful note should be made of the following points:

1. Is it possible to place the casts in the desired anteroposterior relation to each other by straight forward or backward shifting? If not, that is, if it is necessary also to rotate one or the other it is probable that an asymmetry is present. Under these conditions the prognosis is unfavorable unless the asymmetry is very slight because greater posterior involvement would be required on one side than on the other.

2. What changes are necessary in the individual arches to insure good interdigitation of the teeth. These may range from complete treatment of both arches to extraction of certain teeth or the grinding of interfering high points.

It has been assumed in all that has been said thus far that the patient under consideration has attained full growth. The operation should never be advised on a growing individual for the reason that there is apt to be much mandibular growth following resection. The growth of the maxilla on the other hand will not be affected and a disharmony is apt to develop, usually in the form of an open bite.

Choice of Appliance

Any rigid, multiple-band appliance may be employed. It should be realized that even though little or no orthodontic management is necessary before the operation, the appliance will provide the basis of retention while healing is taking place. Since this is of considerable duration the load should be as well distributed over all of the teeth as possible to avoid any extrusion. All of the cases here reported were fitted with the edgewise arch mechanism.

Preoperative Treatment

The orthodontic procedures necessary are carried out in the usual manner and no greater forces should be used than those usually employed in regulating. It is even more important to conserve anchorage in these cases than in routine treatment. As the case nears the completion of this phase new impressions should be made and the models examined for the purpose of determining the exactness of the occlusion to be expected.

The last step in the orthodontic preparation of the case is the inserting of the arches to be used for fixation of the jaws. These arches should be fully seated in all brackets. They should be equipped with vertical spurs, soldered to their gingival surfaces at frequent intervals and, of course, opposite interproximal spaces. These spurs will receive, first the wires for firm fixation and later, the intermaxillary elastics.

Surgical Management

The surgical methods employed in the cases here reported were of two kinds, viz., horizontal or ramus section and condylar. In the first a large curved needle is passed from a point in back of, but close to the ramus, following its medial surface and emerging through the cheek, anterior to the coronoid process. Every effort is made (1) to maintain it on a plane parallel to the occlusal plane; (2) to avoid the vessels and nerves entering the mandible at the foramen and (3) to leave enough bone above the cut to avoid a fracture between the condyloid and coronoid processes. A Gigli saw is attached to the needle and drawn through.

In the condylar cut the needle may be caused to enter at almost any point along the posterior border of the ramus. It is pushed upward, following the medial surface of the ramus to the notch and is then brought out through the cheek.

The outstanding advantage of the condylar cut is the fact that the muscles of mastication are disturbed less and the mandible is left in one piece, as it were, but minus its condylar process. There is of course the possibility of lateral displacement of the condylar process due to the unopposed pull of the external pterygoid muscle, but even this does not seem to have much effect on the outcome of the case.

Material and Methods

From over twenty cases treated during the past four or more years, seven have been selected as representing the group.

All cases here reported were fully equipped with the edgewise arch mechanism, and required preoperative orthodontic treatment. Such treatment ranged from one month to nearly two years. In four of the cases the ramus was sectioned horizontally, and in three the condyle neck was severed.

Following the operation all cases were fixed by wiring the jaws together for a minimum of six weeks, although it is now thought desirable to substitute elastic traction for wiring as soon as the case seems to be stable.

In nearly all cases some orthodontic treatment was found desirable following the period of fixation. The interval between the surgical phase and the removal of all appliances ranged from three months to nine months.

The progress of all cases was followed with cephalometric roentgenograms in the Department of Orthodontia, University of Illinois. In the illustrations accompanying the cases the tracings are oriented to the sella-nasion plane and the left side is indicated by a solid line. In the composite tracings (before and after), the result is indicated by broken lines.

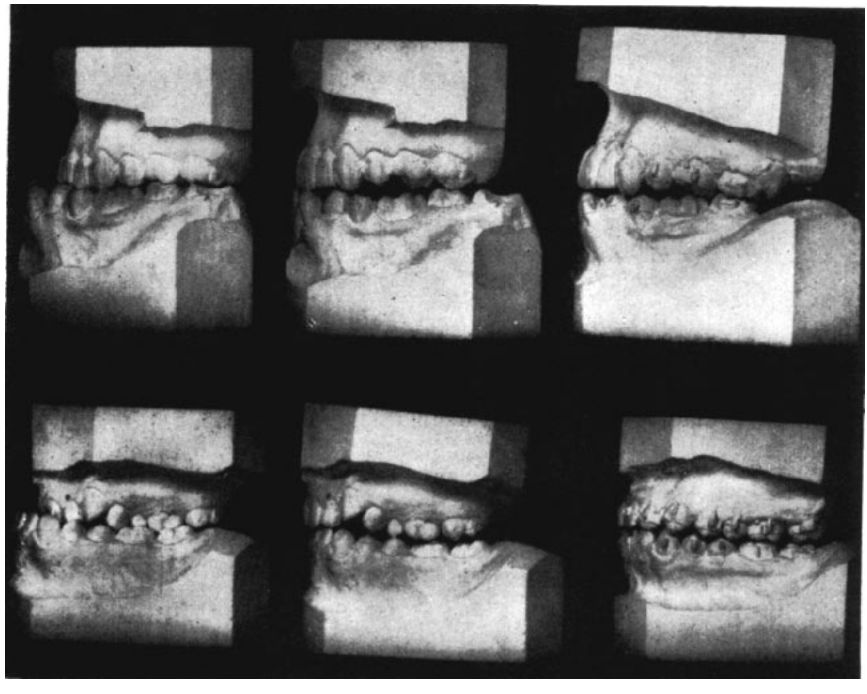

FIG. 1. Shows original casts on left. Casts in desired jaw position in center. Casts in improved occlusal relationship after orthodontic treatment and prior to surgery on right.

Case Reports

Case H.F., Male.

Treated orthodontically in stages over a period of 5½ years. Fig. 2.

Appeared at first as pseudo Class III with upper incisors in lingual occlusion, and space for upper canines completely closed.

Treatment continued until space for maxillary cuspids was nearly attained. Until this point was reached, mandibular growth seemed to follow a fairly normal rate. From then on the mandible seemed to take on a sudden spurt of growth, and in spite of all efforts to restrain it, continued to grow until it reached the stage seen in the third model, Fig. 2.

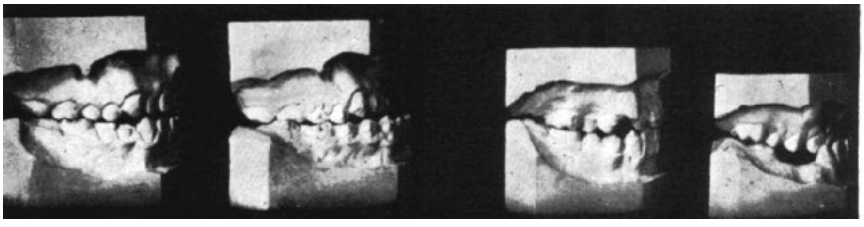

FIG. 2. Case H. F. Models 1-2-3 on the right show the original case, and unavailing efforts of orthodontic treatment prior to the sectioning. Third model shows the case at the time of resection. Last model on left shows case approximately 3 years later.

Fig. 3 represents tracings of X-rays before and after resection. The elapsed time was three weeks.

Fig. 4 is a composite tracing of the case immediately following resection and approximately three years later.

It reveals:

1. Return of mandible to a Class III relation with a slight open bite.
2. A complete remodelling of the ramus since the sectioning.
3. Complete bony union, further illustrated in Fig. 5.
4. Almost complete relapse in relation of body of mandible to cut ramus.

Fig. 6A — Original photos.

Fig. 6B — Photos at time of resection.

Fig. 6C — Photos taken three years and four months after resection.

Case H.M., Male.

This case presents some characteristics similar to the preceding case. The patient was only 15½ years of age. The case as seen in Fig. 7-A had already been resected about three months prior to the taking of the models. Orthodontic treatment had not been attempted prior to the resection and fixation had been accomplished by wiring directly to the teeth.

In addition to an enlarged lower arch, there was a much reduced maxillary arch. At about the age of nine the patient sustained an accident in which the upper left central was lost and the lateral damaged. The space for the central was completely closed while the lateral was almost completely locked lingually. The maxillary arch was consequently shortened the width of two teeth. Fig. 8A.

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FIG. 3 (left) Tracings of case before resection; (right) after resection. Solid lineshows patient's left side.

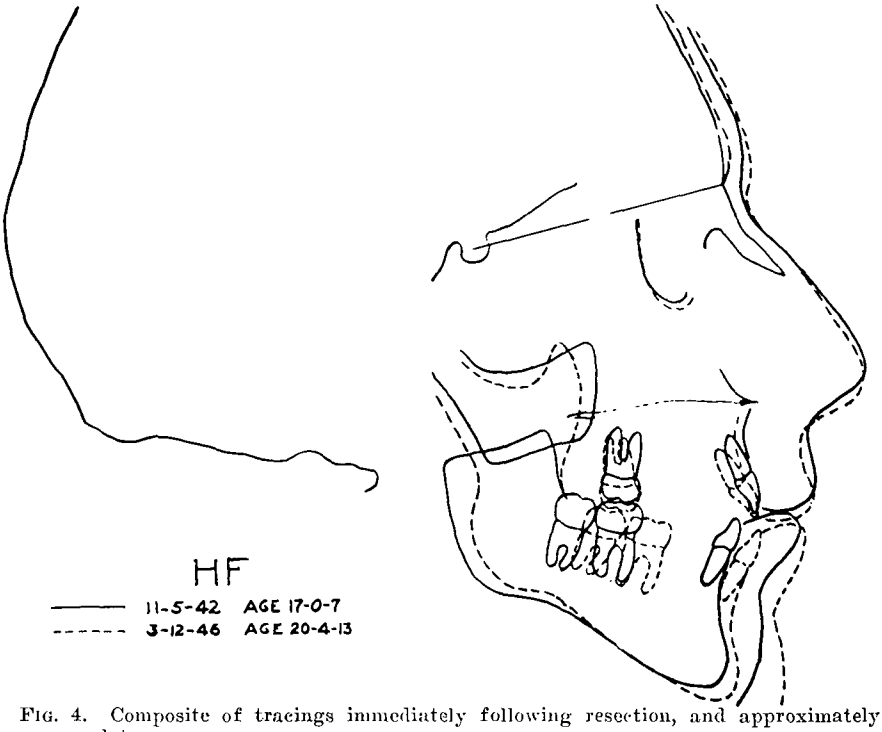

FIG. 4. Composite of tracings immediately following resection, and approximately three years later.

The placing of the two arches using the models in a relative Class I relation, failed to establish any secure form of occlusal relationship. Following the first operation the patient, in seeking a better occlusal resting place, aided the mandible to return to its original position. Coupled with this was the youth of the patient, and in all probability an active growth. In fact, during the following year the patient grew about five inches in height. An endocrine assessment failed to disclose any dysfunctions or abnormalities.

The relapse having occurred, the case was studied further, and orthodontic treatment was decided upon and carried on for nearly 18 months. The upper arch was enlarged by opening space for the lateral. A better occlusal relationship was obtained and resection was again resorted to, with the result seen in Fig. 8B.

Fig. 9 represents the tracing of the case four months after the original resection.

Fig. 10 represents the tracing of the case immediately following the second sectioning.

Fig. 11 shows the tracing of the case after all appliances had been removed about six months after the second resection. It reveals a rounding off of the sharp spicules at the sites of the cut, with a possible union. However, there also seems to be a tendency for the mandible to go forward again.

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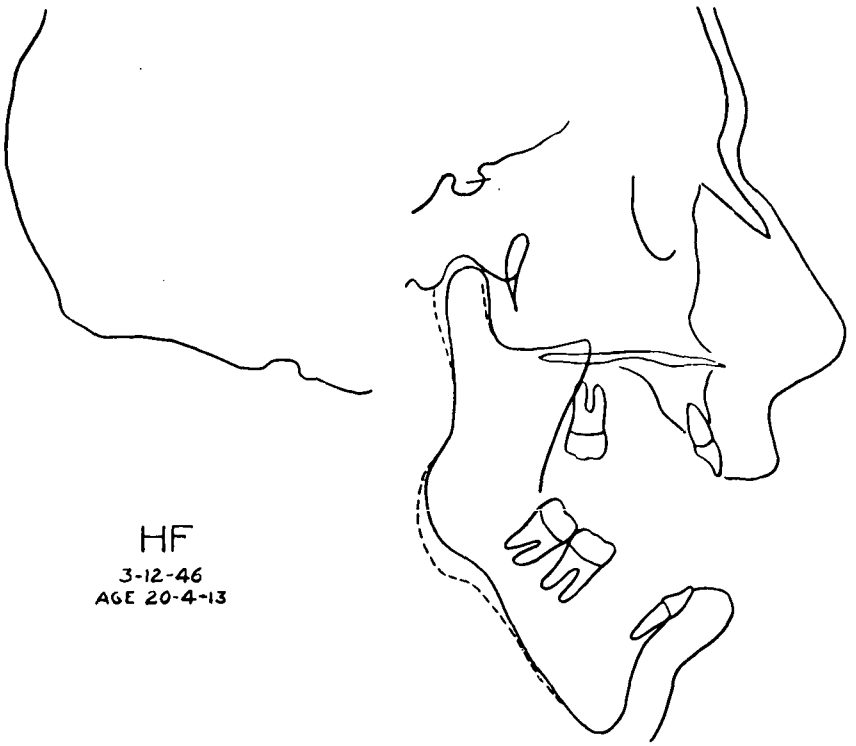


FIG. 5. Tracing of X ray taken with mouth wide open showing further evidence of complete bony union.

FIG. 6a. Original photos.
(See Fig. 2).

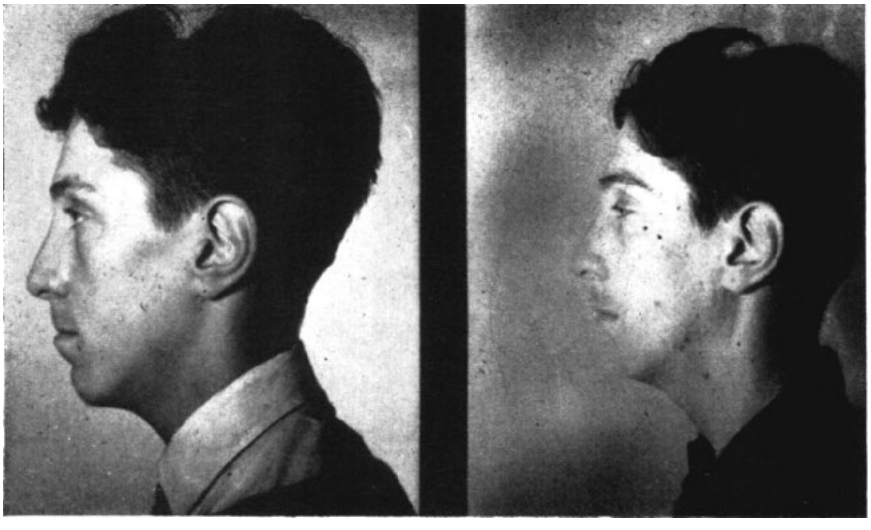


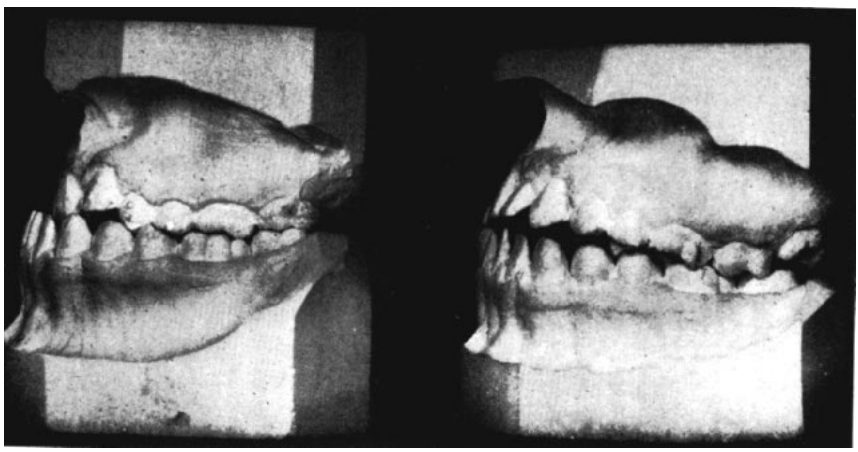
FIG. 6b. Photo at time of operation (see Fig. 2).

FIG. 6c. Photos taken three years and four months after resection. (see Fig. 2).

Fig. 12 — Photos before the first and following the second resection.

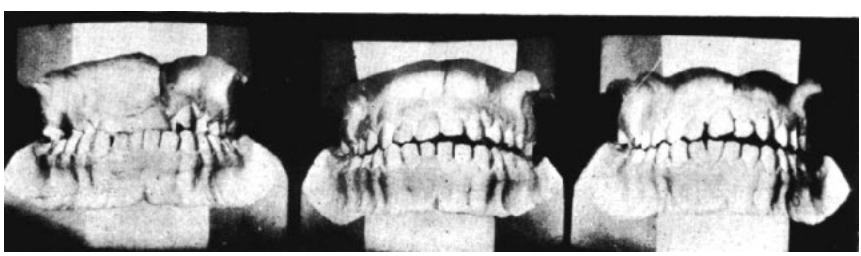
Fig. 13-a-b-c illustrates x-ray tracing, models and photos of the case about 2½ years after the second operation. They reveal a complete relapse of the case after being resected twice.

The last two cases described were those of young patients, and should serve as a warning. Growth maturity had not been reached at the time of the sectioning. Consequently growth continued after the sectioning with the subsequent relapse.



A B

FIG. 7. Case H. M., Male. Models of case as it appeared for treatment. Case had already been resected once about 3 months previously.



A B C

FIG. 8. Case immediately after second operation.

Case F.W., Male — Age 20.

Fig. 14-a illustrates models and photos of case before and after sectioning.

Neither the external appearance of the face Fig. 14-b, nor the tracing (Fig. 15), reveals a typical Class III picture, nor a typical Class III mandible. The mandibular angle is more acute than in most cases.

Ten months of orthodontic treatment were required to prepare the arches prior to resection.

Fig. 15 illustrates tracings of the case before and after sectioning.

It reveals a horizontal type of cut. The short fragment is pulled upward and forward by the temporal and external pterygoid muscles, and it appears as though there is hardly more than a point contact between the fragments.

Elastics were used three weeks after the operation to aid in anterior bite closure.

Fig. 16-a (left) shows tracing of the case about four months after the resection.

It reveals some rounding of the cut edges and a larger surface area in contact.

Fig. 16 (right) reveals the fact there is still incomplete union, with the fragments opening in anterior half when the jaws are held wide open.

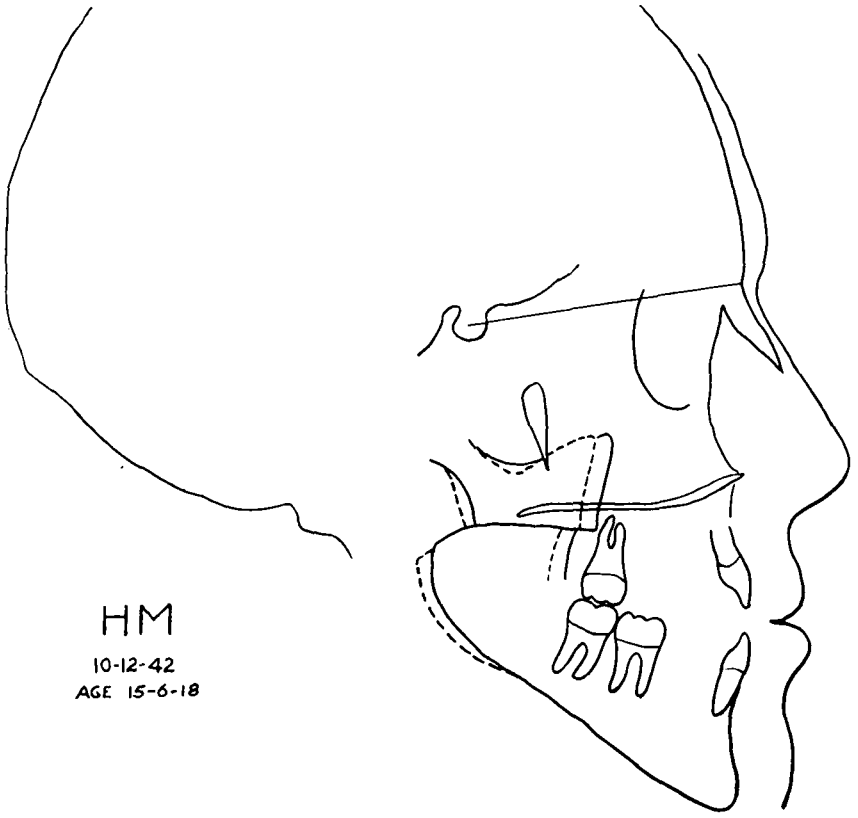


FIG. 9. Case H. M. Cephalometric tracing of case as seen four months after original sectioning.

Case G.C., Female — Age 21

Treated by horizontal sectioning of ramus. Orthodontic treatment for three months prior to operation. Class III elastics were placed about one month after operation, and orthodontic treatment was continued for about five more months to effect the excellent occlusal results seen, Fig. 17-a, b. Third molars had to be removed in order to aid in establishing the occlusion.

Fig 18 shows tracings of case before and after the sectioning. The mandible has more nearly the typical Class III form.

Fig. 19 is a composite of the tracings shown in Fig. 18.

This reveals the striking change in the position of the mandible. The short fragment has been pulled upward by the temporal and external pterygoid muscles, while the large fragment has been pulled downward and backward by the infrahyoid muscles.

The amount of reduction can easily be noted, while the mandibular angle has been made even more obtuse. The esthetics have definitely improved.

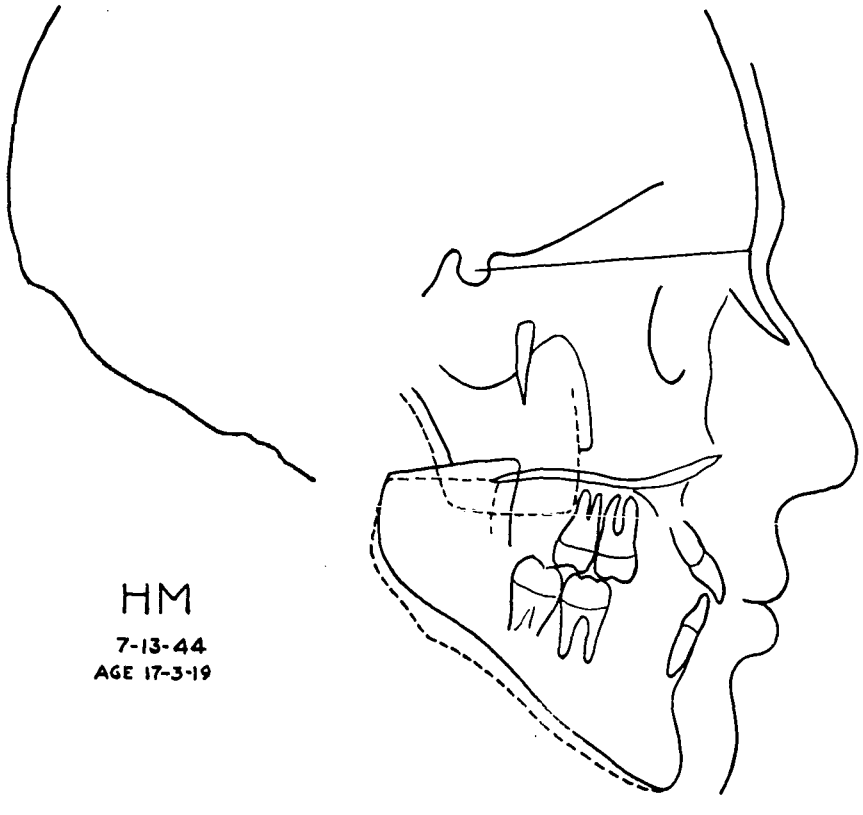


FIG. 10. H. M. Tracing of case immediately following second section.

Fig. 20 (upper) illustrates tracings of x-rays taken nine months after the case was dismissed. It reveals the following:

(a) Extensive remodelling with complete bony union on the right side, and less complete union on the left side.

(b) The excellent occlusion has been maintained.

Fig. 20 (lower) further corroborates these findings. These are tracings of laminograph X-ray pictures taken to check the condylar areas. These were taken with the mouth wide open. This case is highly successful to date, and all indications point to further improvement and stablility.

Case V.P., Female—Age 29.

This case had very little orthodontic treatment prior to the sectioning and the condylar cut was employed.

Subsequently the case had four to five months of orthodontic treatment to complete the case as seen, Fig. 21.

Fig. 22 represents tracings of the case before and after sectioning, showing the direction and location of the condylar cut.

Fig. 23. Laminograph X-rays taken five years later reveal complete remodelling with complete bony union.

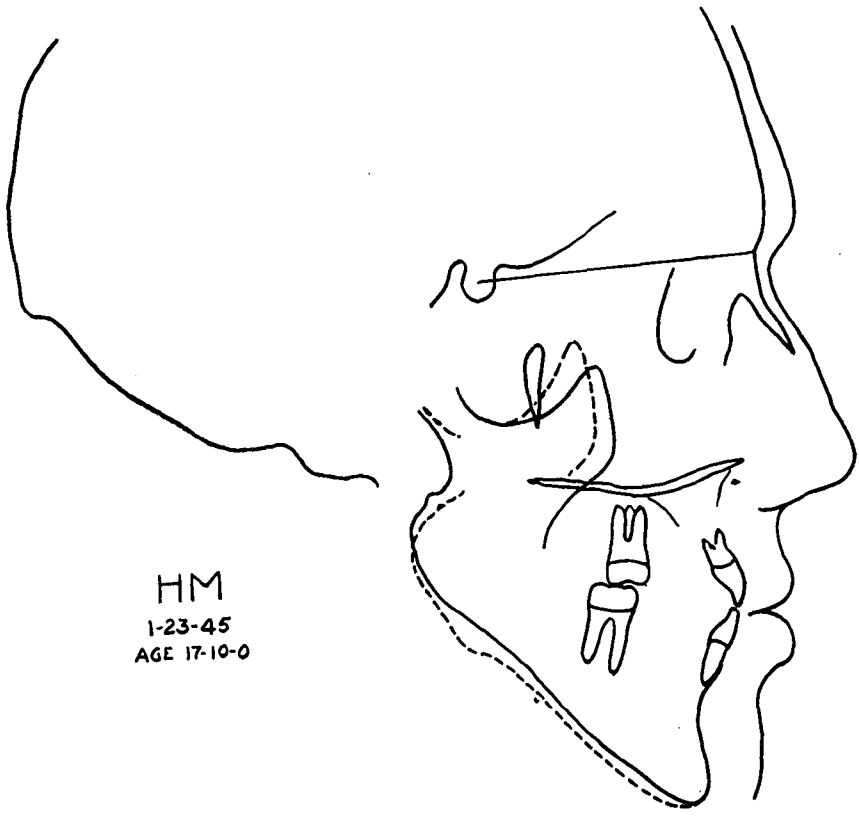


FIG. 11. H. M. Tracing of case six months after second operation. Note the rounding off of the sharp spicules at the sites of the cut, with apparent union. However, there also seems to be a tendency for the mandible to go forward again.

Case H. H., Male—Age 24.

Fig. 24 illustrates models and photos of case, before and after sectioning. This case was sectioned by a large oblique cut thru the ramus leaving both condyle and coronoid processes intact. On the right side the cut ends approximated each other in a butt joint, while on the left side the fragments overlapped with the small fragment medially. This may be due to the strong pull of the external pterygoid muscle in a medial direction.

Fig. 25 represents tracings of the X-rays of the case before and after the sectioning, and reveals the location and type of cut.

Fig. 26 is a composite of the tracings in Fig. 25, and reveals the changes occurring after the sectioning. Note the change in the mandibular angle.

Fig. 27 reveals the status of the case three years later, showing extensive remodelling.

Fig. 27 also shows straight condylar X-ray tracings, and illustrates the changes that have occurred since the time of the sectioning. There has been complete bony union on both sides with complete remodelling.

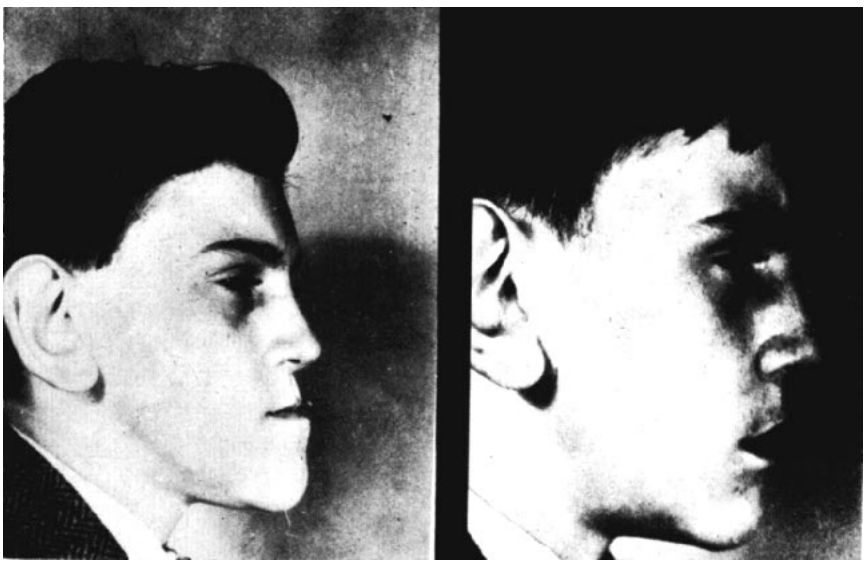


FIG. 12—Case H. M. Photos before the first and following the second resection.

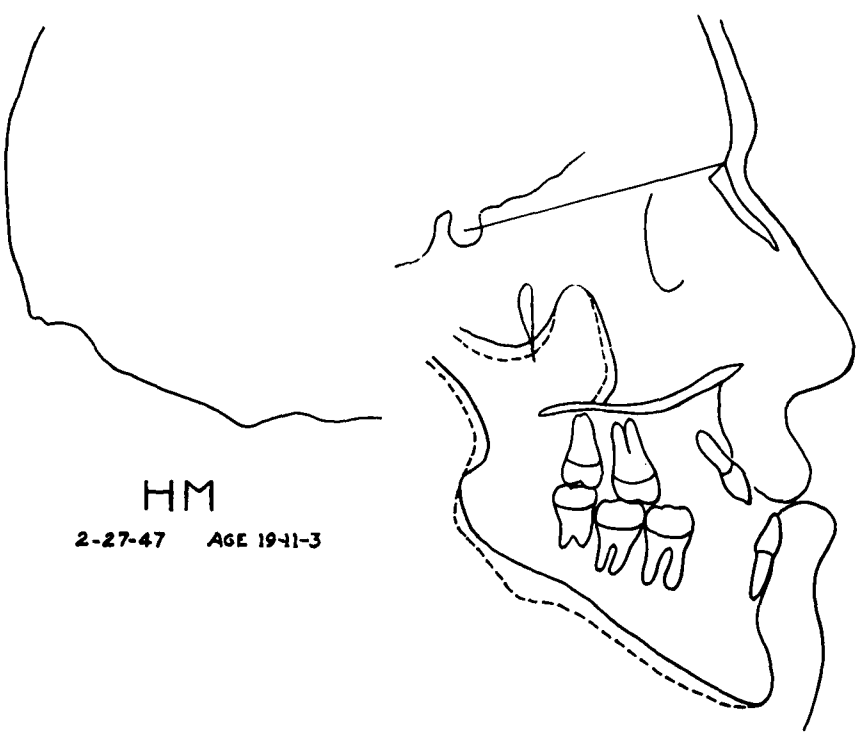


FIG. 13a. Case H. M. Cephalometric tracing of the case about 2½ years after the second operation. It reveals a complete relapse of case after being resected twice. (See Figs. 13b, 13c).

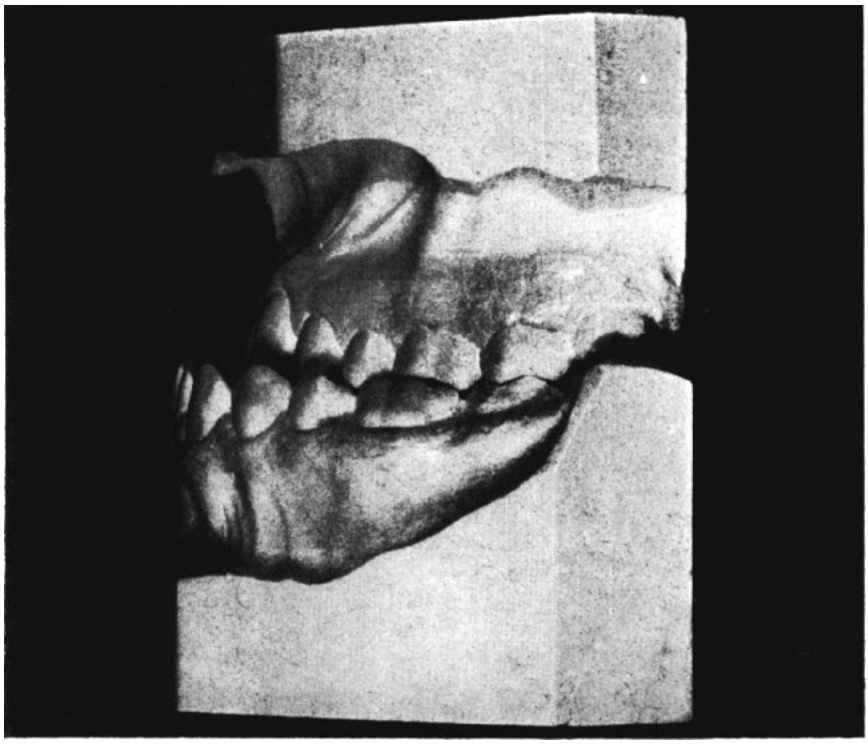


FIG. 13b. Models of case 2½ years after resecting. Note relapse. (See Figs. 13a, 13c).

Case H. S., Female—Age 24.

This case was treated by a condylar section. A large cut was made running from the sigmoid notch to the angle of the mandible. Orthodontic treatment was not undertaken due to the mutilated condition of the denture. The result is most excellent.

Figs. 28 and 29 show models and photos of case, before and after the sectioning.

Fig. 30 represents tracings of the case before and after the sectioning.

Fig. 31 is a composite of the tracings seen in Fig. 30.

Fig. 32 is a tracing of the case taken a little more than two years later and shows complete remodelling and bony union. The case is most stable and the result excellent.

The last two cases, namely, Case H.H. and Case H.S., were studied and assessed by Dr. William B. Downs in—his studies of "Variations in Facial Relationships." He found that the changes brought about by the sectioning, helped these cases to attain facial patterns that fell well within the normal range.

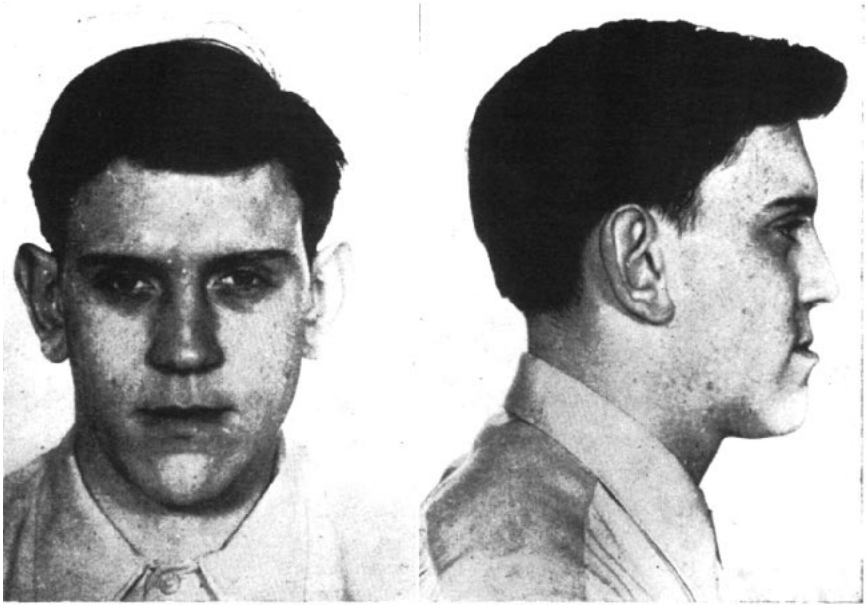


FIG. 13c. Photographs of case 2½ years after resection.
(See FIGS. 13a, 13b).

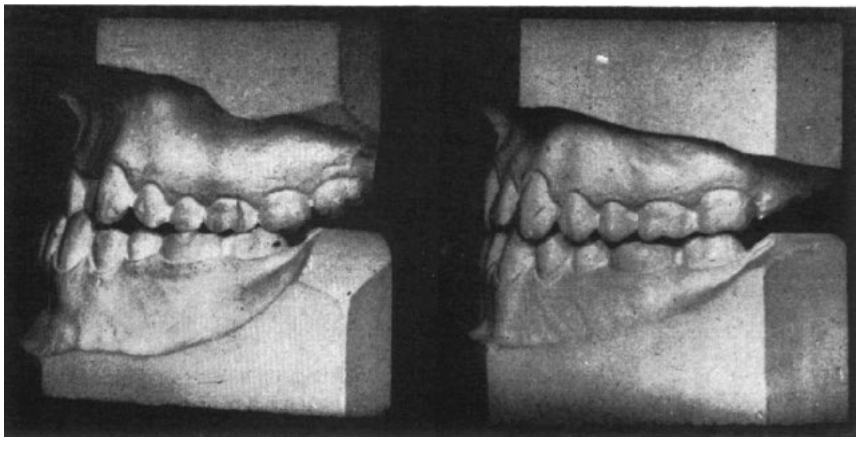


FIG. 14a. Case F. W., Male. Models and photos before and after sectioning.

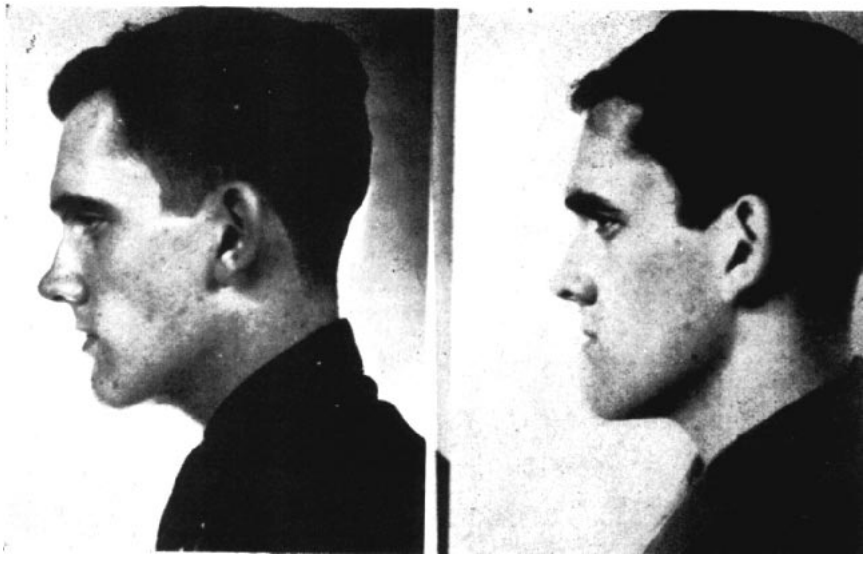


FIG. 14b. Face before and after sectioning.

Summary and Conclusions

A group of seven cases, representative of a sample of more than twenty cases of Class III malocclusion treated by combined surgical orthodontic methods has been studied. A good functional occlusion combined with asethetic improvement of the face and bony union of cut surfaces has been the criteria of complete success. These have been appraised by means of models of the dental arches, photographs of the face and lateral cephalometric roentgenograms. The general conclusions derived from the findings were as follows:

(1) All cases should be studied from adequate records prior to management with a view to determining:

a. Amount and kind of preoperative orthodontic treatment needed to give the greatest occlusal retention.

b. The best type and direction of surgical section. (To date evidence lies on the side of the condylar cut.)

(2) A rigid, multiple-band technique should be employed in order to distribute the load of post-operative retention over as many teeth as possible. The surgical correction of mandibular position is not difficult, the maintenance of the new position presents the major problem.

(3) Bony union is usually obtained although only after varying periods of time. It is most prompt in those cases where a maximum surface contact is obtained and when a minimum of displacement occurs.

(4) There is sometimes paresthesia following the surgery but in none of the cases was this complete or permanent. It is usually restricted to the lower lip.

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FIG. 15. Case F. W. Cephalometric tracings of case before and after resection.

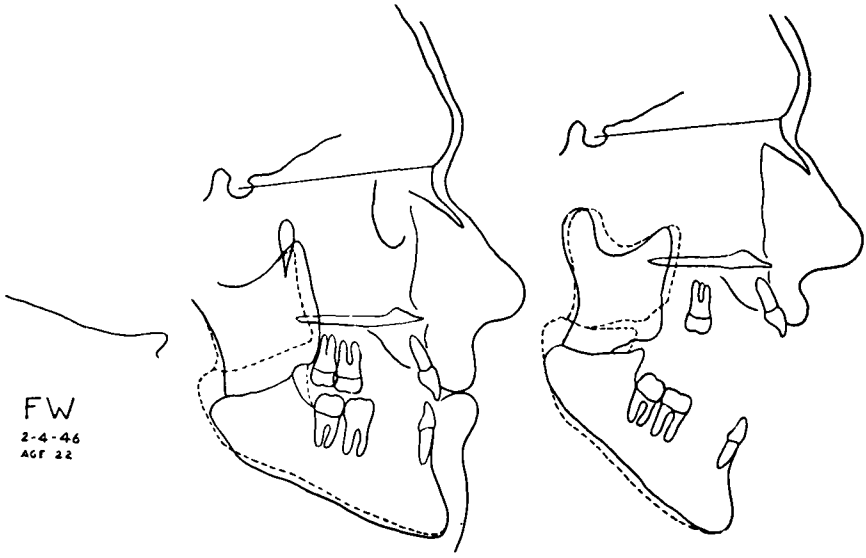

FIG. 16. Cephalometric tracing of case four months after the resection. Reveals some rounding of cut edges and a large surface area in contact. Also incomplete union with the fragments opening in anterior half when the jaws are held wide open.

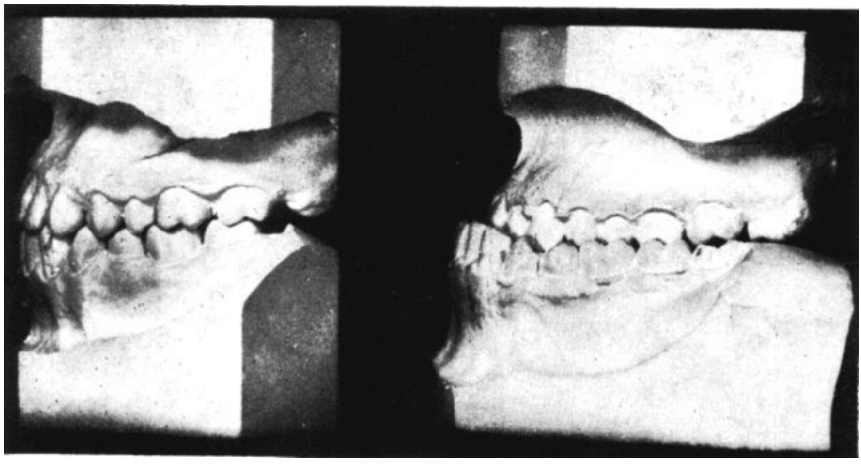

FIG. 17a. Case G. C., Female. Models before and after sectioning.

FIG. 17b. Photographs before and after sectioning.

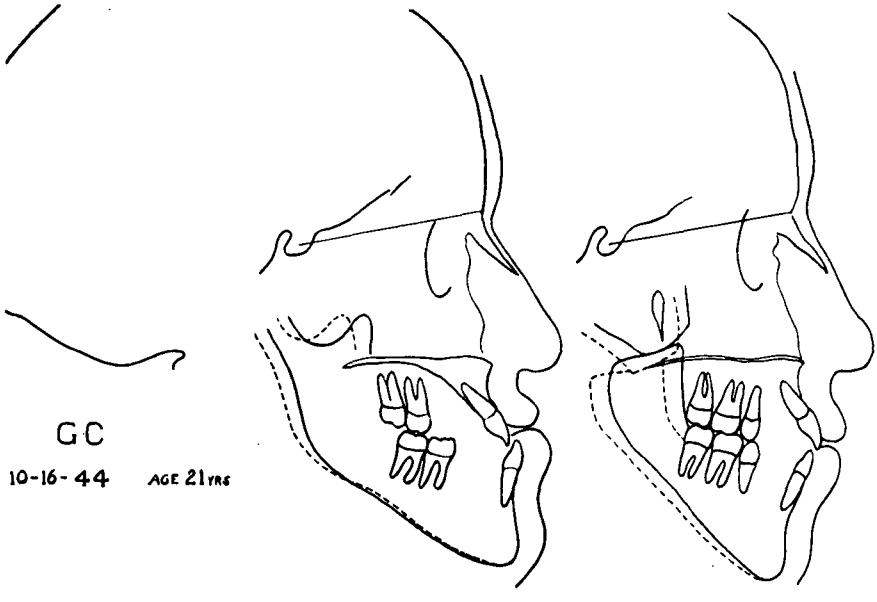

FIG. 18. Case G. C., Female. Cephalometric tracings of case before and after the sectioning. (Interval: 13 months.)

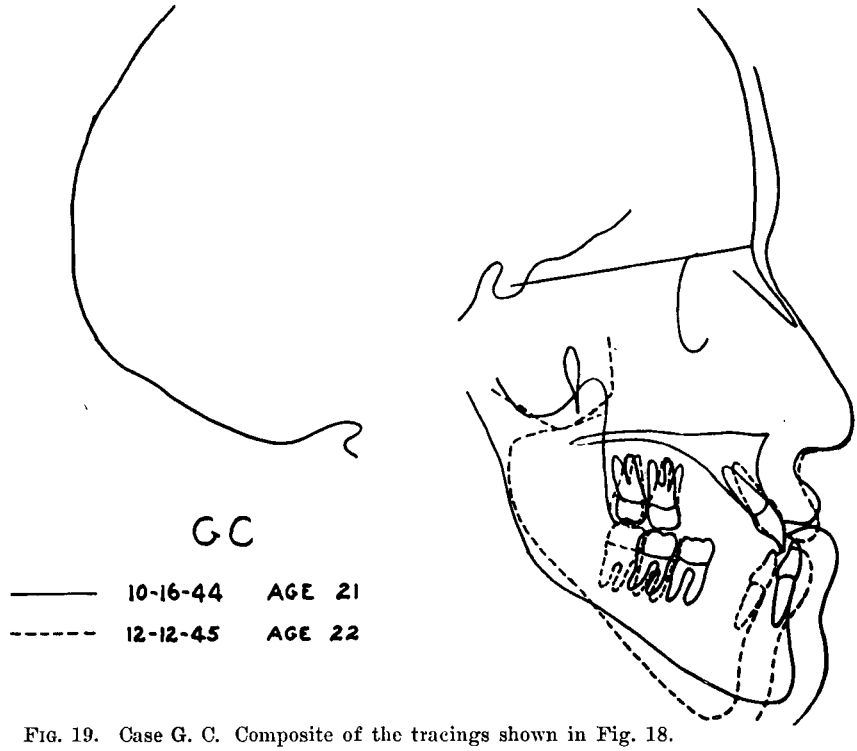

FIG. 19. Case G. C. Composite of the tracings shown in Fig. 18.

(5) Occlusal function was good after treatment.

(6) The operation should not be performed on individuals who are still growing if permanence of result is to be expected.

(7) Improvement of facial lines can be expected in practically all cases.

(8) Most cases can be improved by post-operative orthodontic treatment.

(9) In nearly all cases the patients are extremely grateful.

58 E. Washington St.

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(Continued on Page 91)

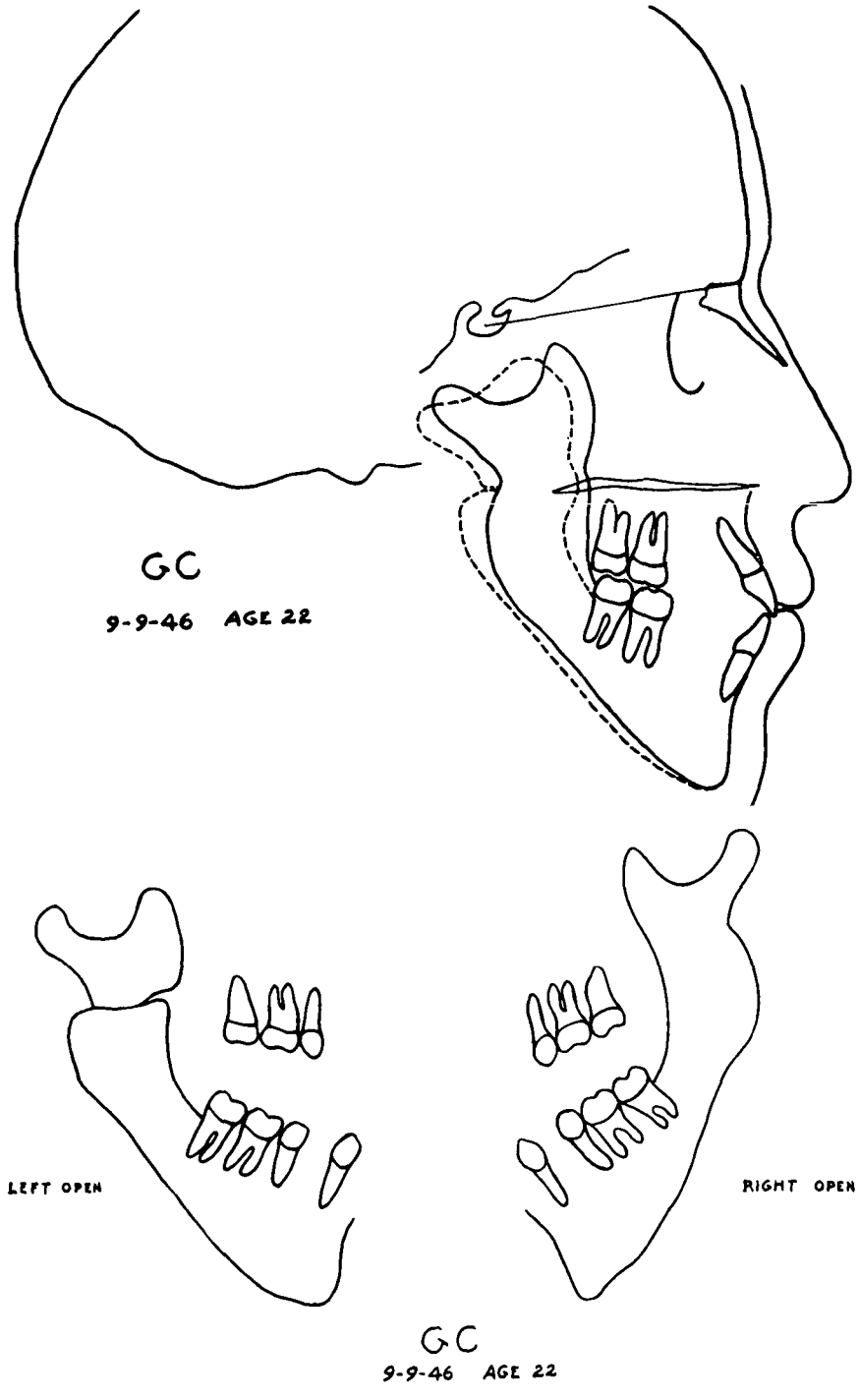

FIG. 20. A and B, Case G. C. A. Cephalometric tracing nine months after case was dismissed. B. Tracings of laminagraph X rays taken at same time. Note complete bony union on right side and less complete on left side.

FIG. 21

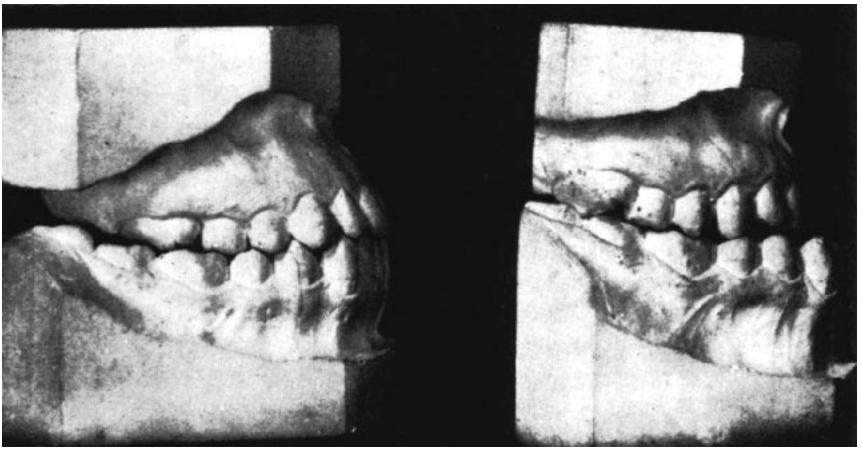

FIG. 21. Case V. P., Female. Models and photos of case before and after sectioning.

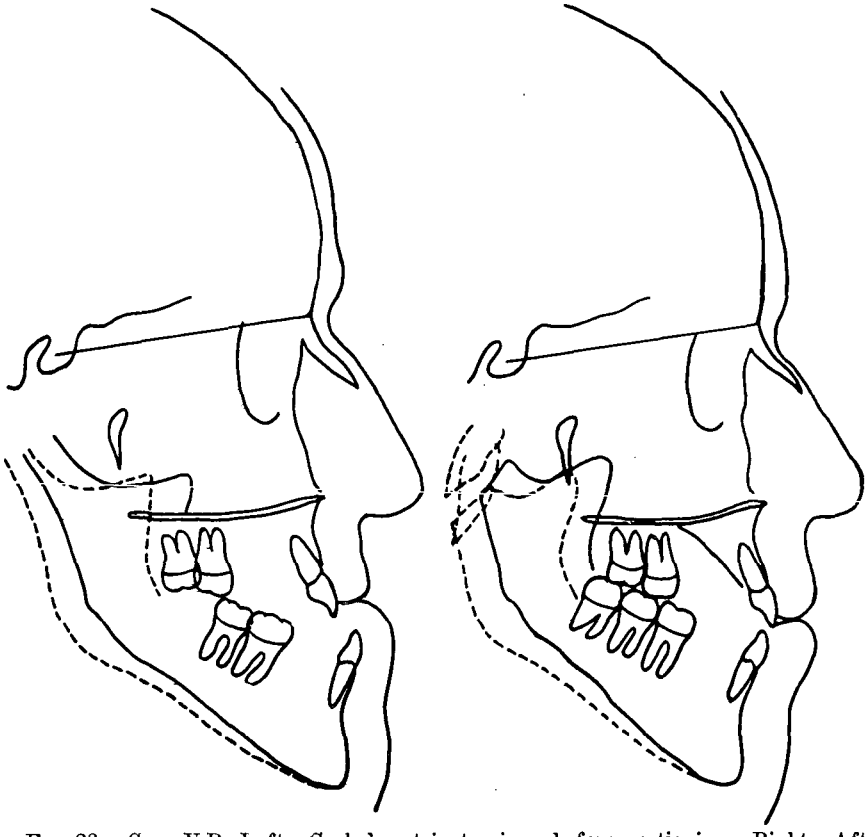

FIG. 22. Case V.P. Left: Cephalometric tracings before sectioning. Right: After sectioning. Note location and direction of condylar cut.

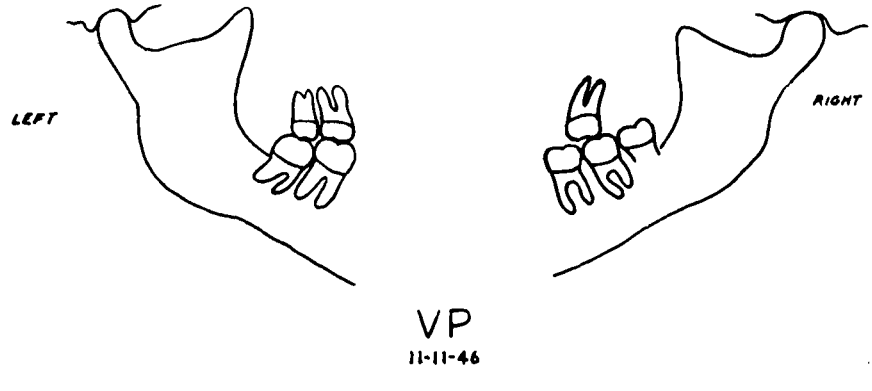

FIG. 23. Case V. P. Tracings of laminagraph X rays taken five years after operation, reveals complete remodelling with complete bony union.

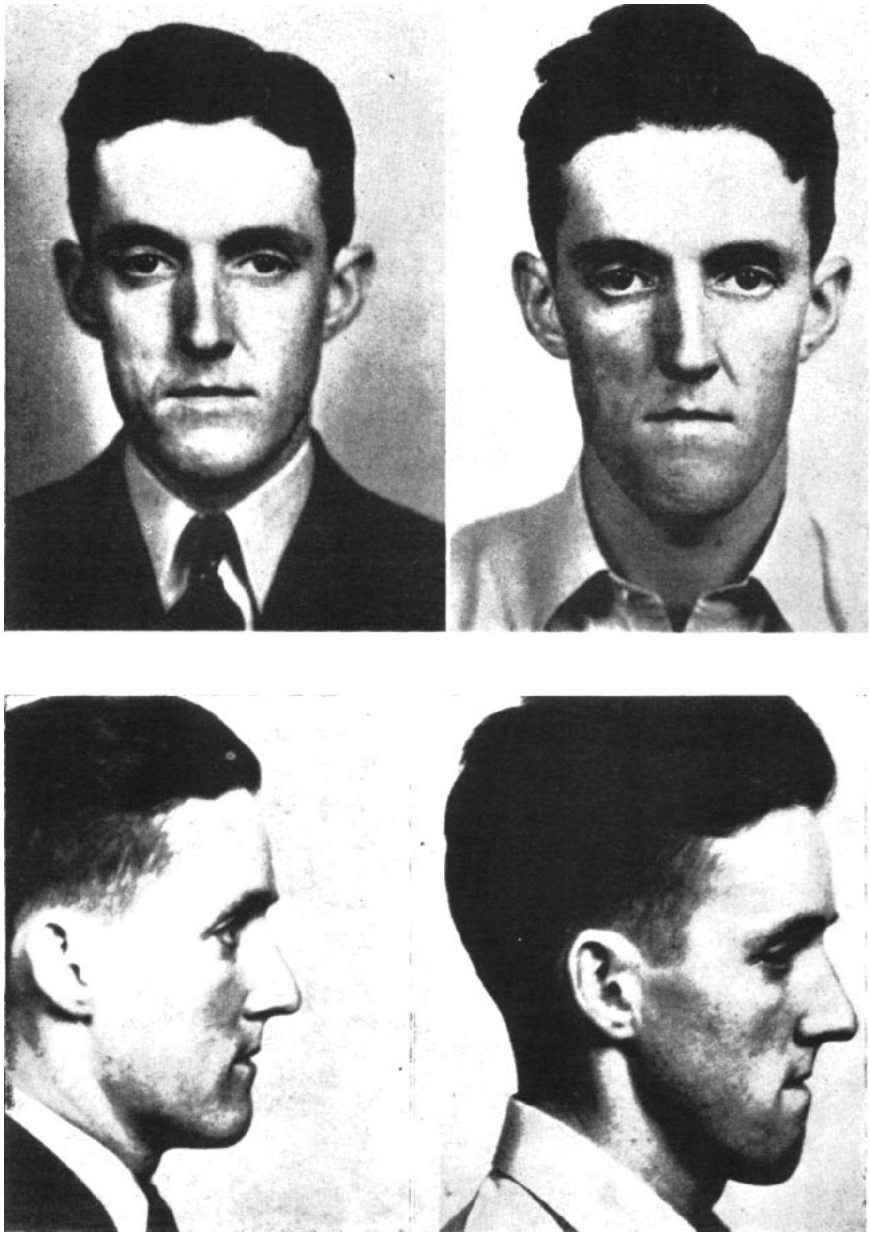

FIG. 24

Case H. H. Photos after and before resection.

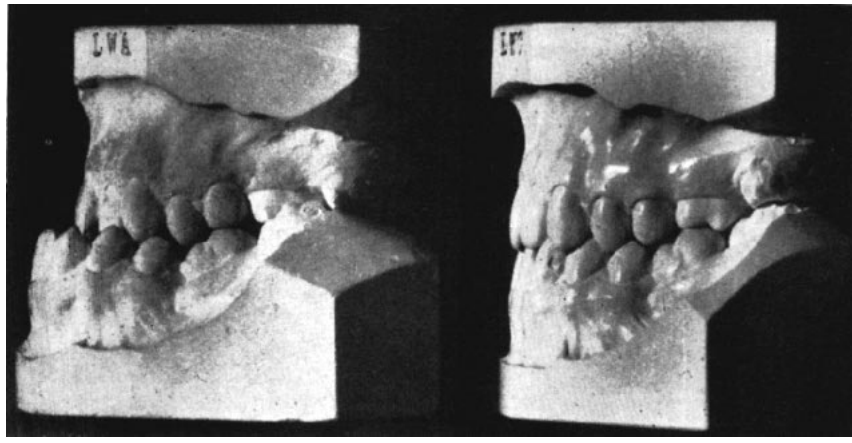

FIG. 24. Case H. H., Male. Models and photos of case before and after sectioning. (See preceding page.)

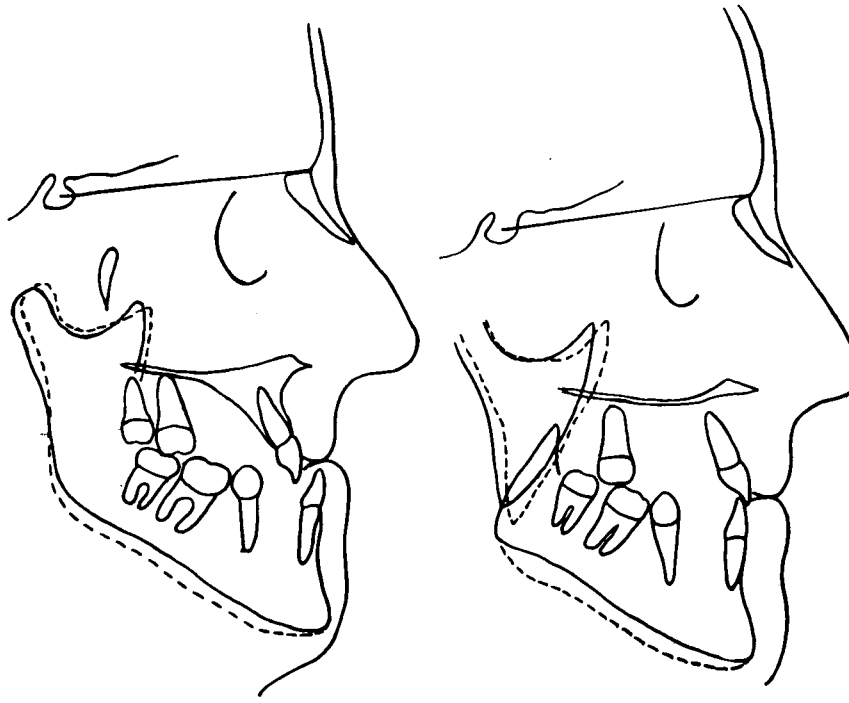

FIG. 25. Case H. H. Cephalometric tracings of case before and after sectioning. Reveals location and type of cut.

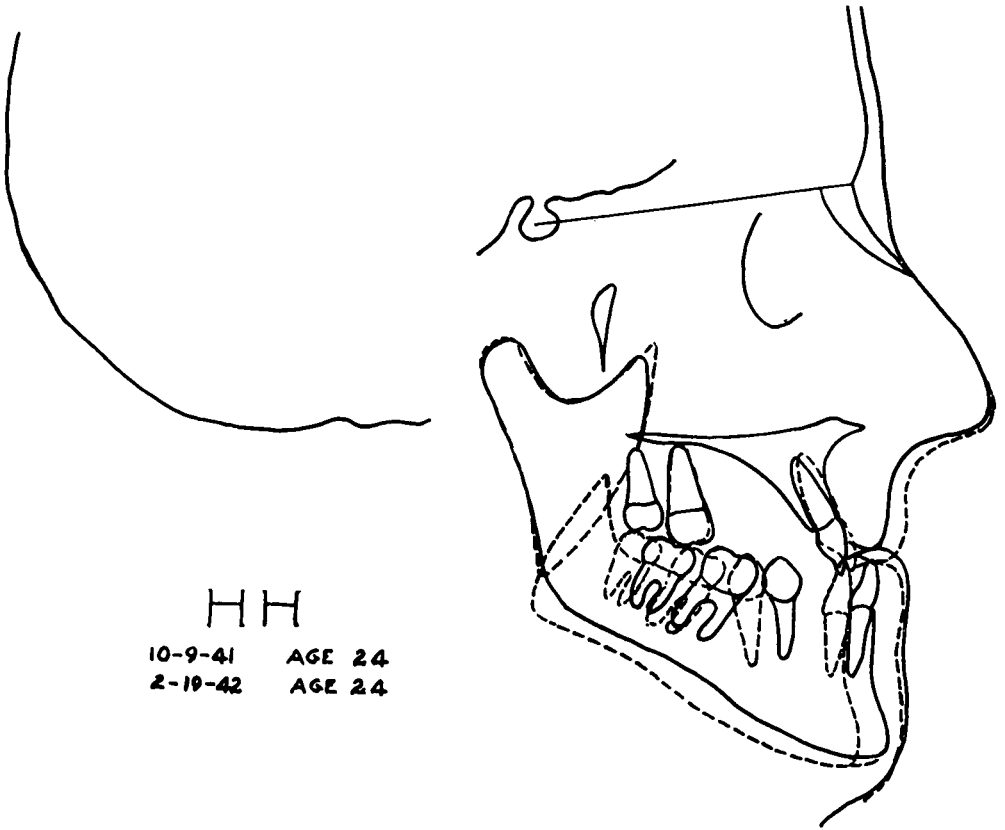

FIG. 26. Case H. H. Composite of tracings in Fig. 26.

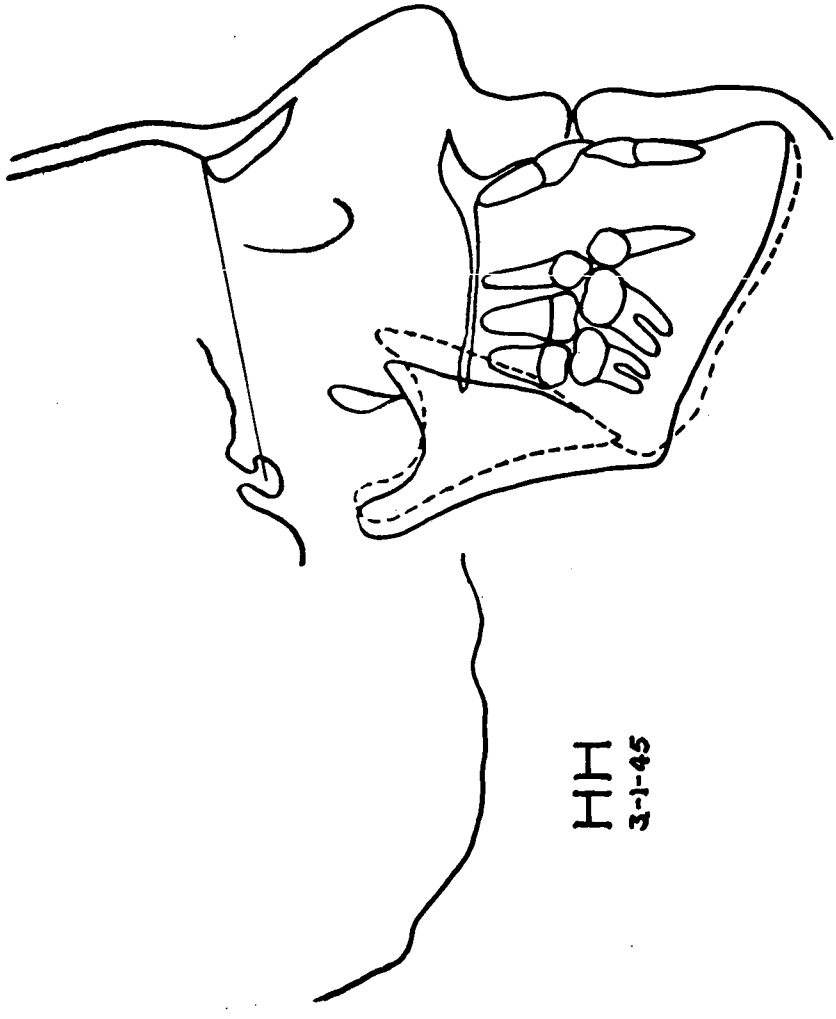

FIG. 27

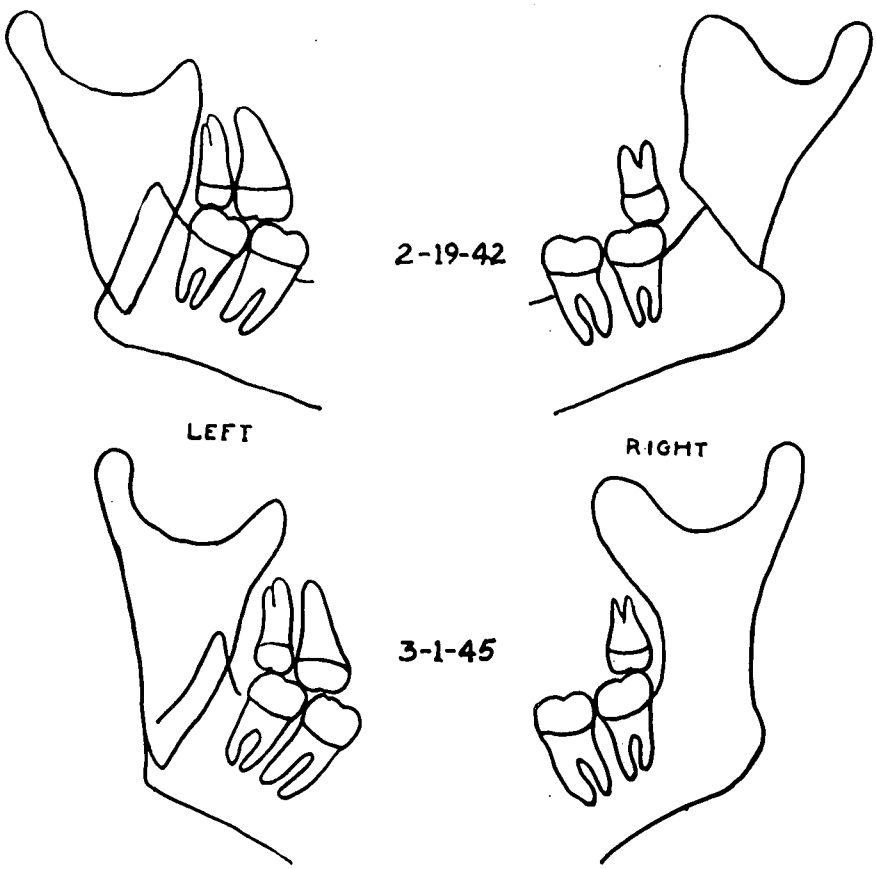

FIG. 27. Case H. H. A. Tracing of case three years later showing extensive remodelling. B. Straight condylar X ray tracings, illustrating the changes that have occurred since the time of the sectioning. Note complete bony union on both sides, with remodelling. (See opposite page.)

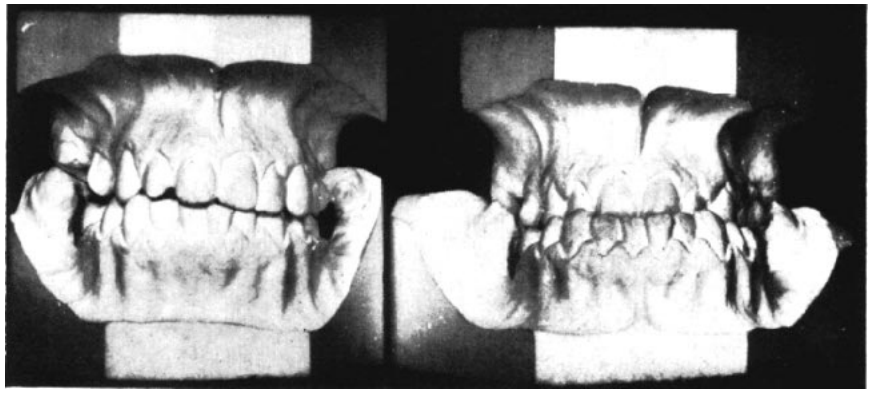

FIG. 28

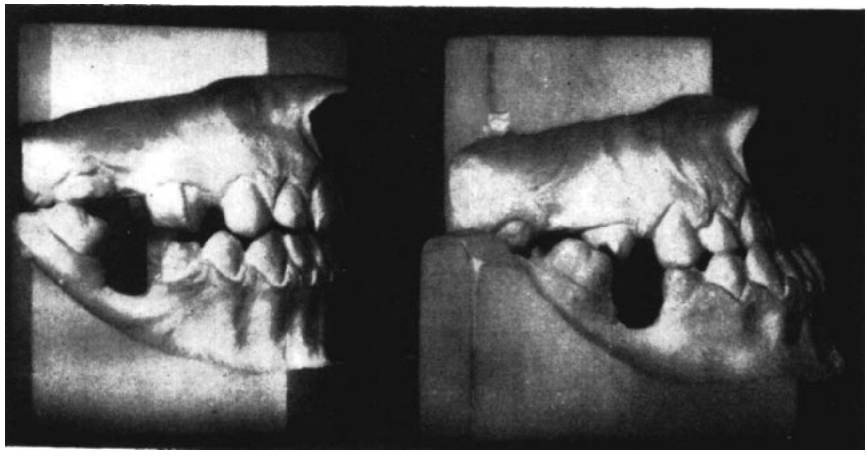

FIG. 28. Case H. S., Female. Models of case before and after sectioning.

FIG. 29

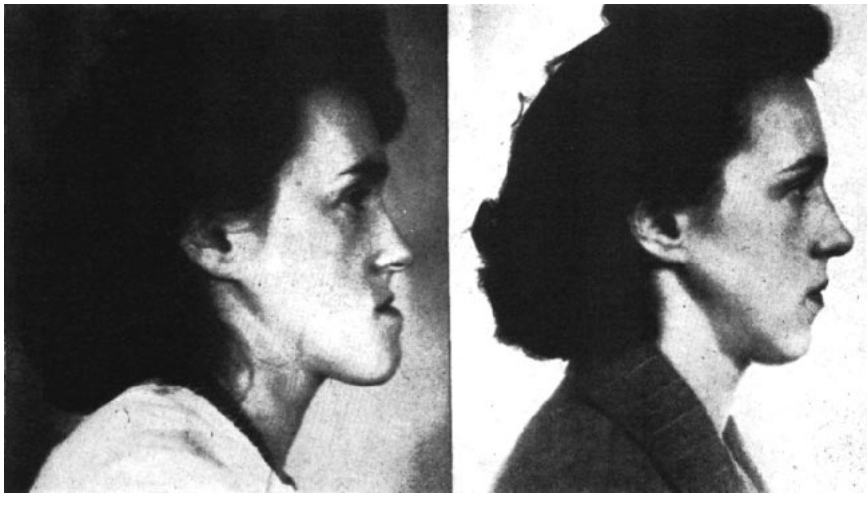

FIG. 29. Case H. S. Female. Photos taken before and after sectioning.

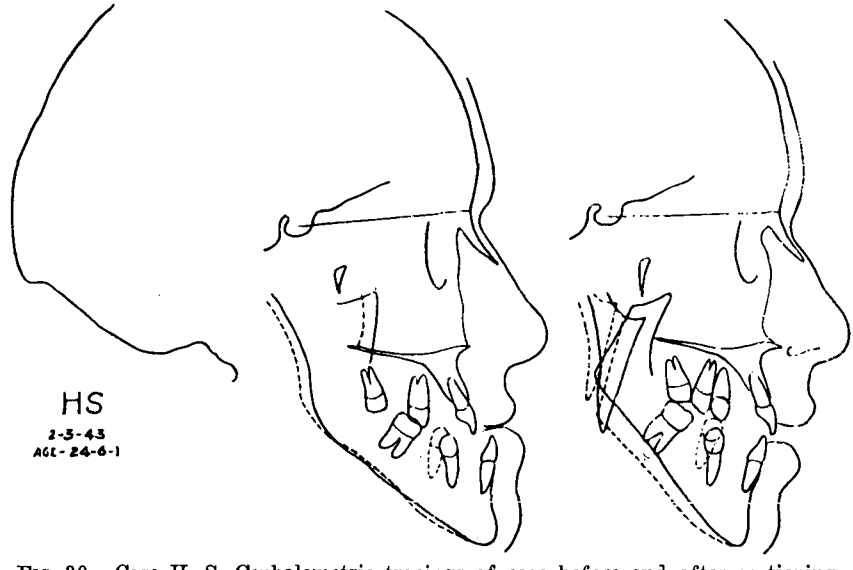

FIG. 30. Case H. S. Cephalometric tracings of case before and after sectioning.

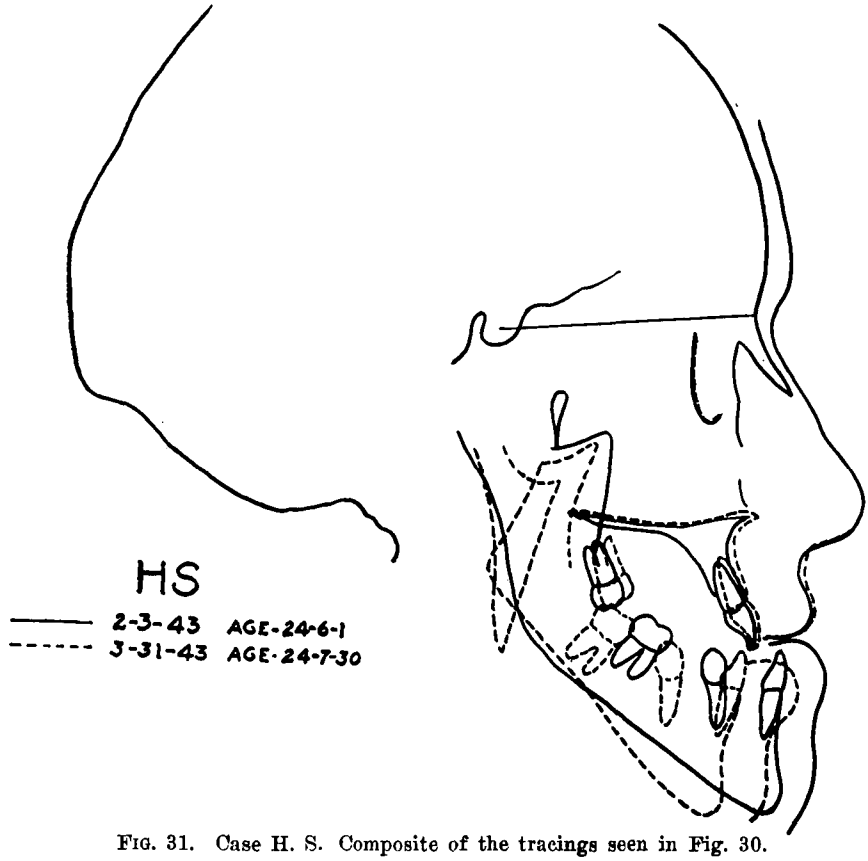

FIG. 31. Case H. S. Composite of the tracings seen in Fig. 30.

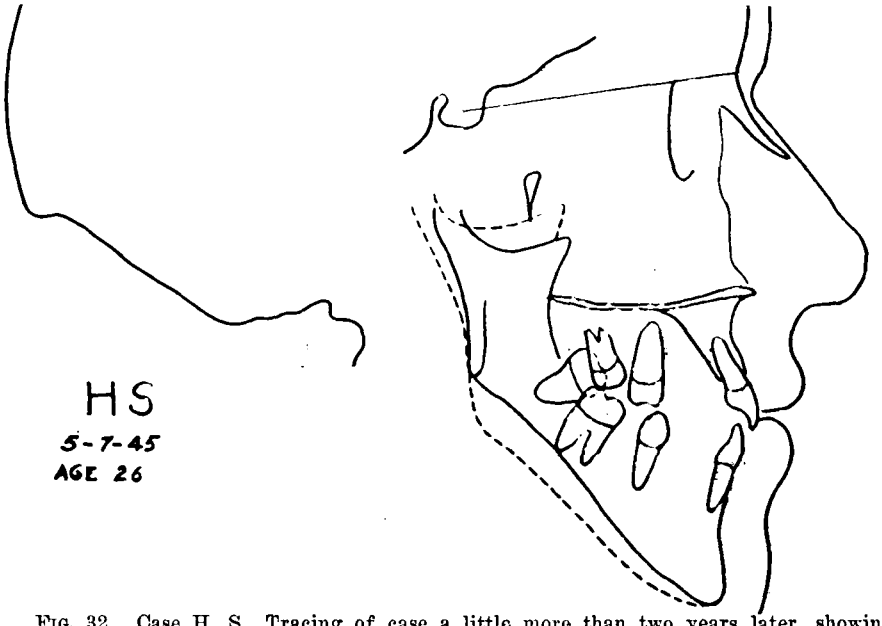

FIG. 32. Case H. S. Tracing of case a little more than two years later, showing complete remodelling and bony union.

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