Analysis of Jaw Relation in Treated Class II Malocclusion

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There are many dentists who accuse the orthodontist of ignoring "centric relation" and paying little or no attention to occlusal relations of teeth except when the jaws are closed. No doubt some of this criticism is deserved because in years past many orthodontists have deliberately tried to reposition mandibles in treatment merely for better esthetics. Many of those who criticize the orthodontist attach a great deal of importance to establishing correct jaw relationship. Some believe that gradual periodontal destruction, abnormal occlusal wear, or temporomandibular joint disturbances are inevitable when occlusal interferences are present. They believe further that the only way one can properly analyse an occlusion is by mounting the casts in an adjustable articulator. However, most orthodontists have been reluctant to do this, perhaps mainly because of the disagreement which exists over what constitutes correct jaw relationship. It seems that the controversy centers around two major schools of thought. The retruded position of the mandible advocated by the McCollum school and the rest position recommended by the Thompson school have both been designated as optimal jaw relation and both have been regarded as "centric relation."

In view of this controversy this paper will consider jaw relationship particularly regarding the antero-posterior position. The first part will deal with testing several methods of mounting casts of natural teeth in the articulator. The second part is concerned with analysis of treated Class II malocclusions.

*Presented before the Mid-Western component, Detroit, Michigan, January 1954.

METHODS OF MOUNTING CASTS IN THE ARTICULATOR

It seems impossible to discuss jaw relationship without also mentioning some of the problems concerned with using an articulator. Many opinions exist as to what constitutes the best practical procedure for making the transfer so it is understandable that some dentists have come to trust a barn door hinge as much as some of the chromium plated devices in use today.

In order to test the various methods of registration two adults with normal occlusions were selected. The first method involved the use of the rest position bite in conjunction with the face bow transfer. The upper cast was mounted by placing the face bow rods on the arbitrary points 13 mm. in front of the ear hole on the eye ear plane (Fig. 1ABC). Then the lower cast was related to the upper by means of the rest position bite. Repeated attempts using this method resulted in the anterior teeth striking first while the posterior teeth were out of occlusion.

The same cases were then mounted using the retruded bite with the face bow transfer. The upper cast was mounted in the same way as before by placing the face bow rods on the arbitrary points as advocated by Hanau. One would expect that if the patient's mandible could be retruded slightly beyond the intercuspal position and the retruded bite is used, the mounted casts would show this relationship. However, the result was not as expected. The anterior teeth came into contact first

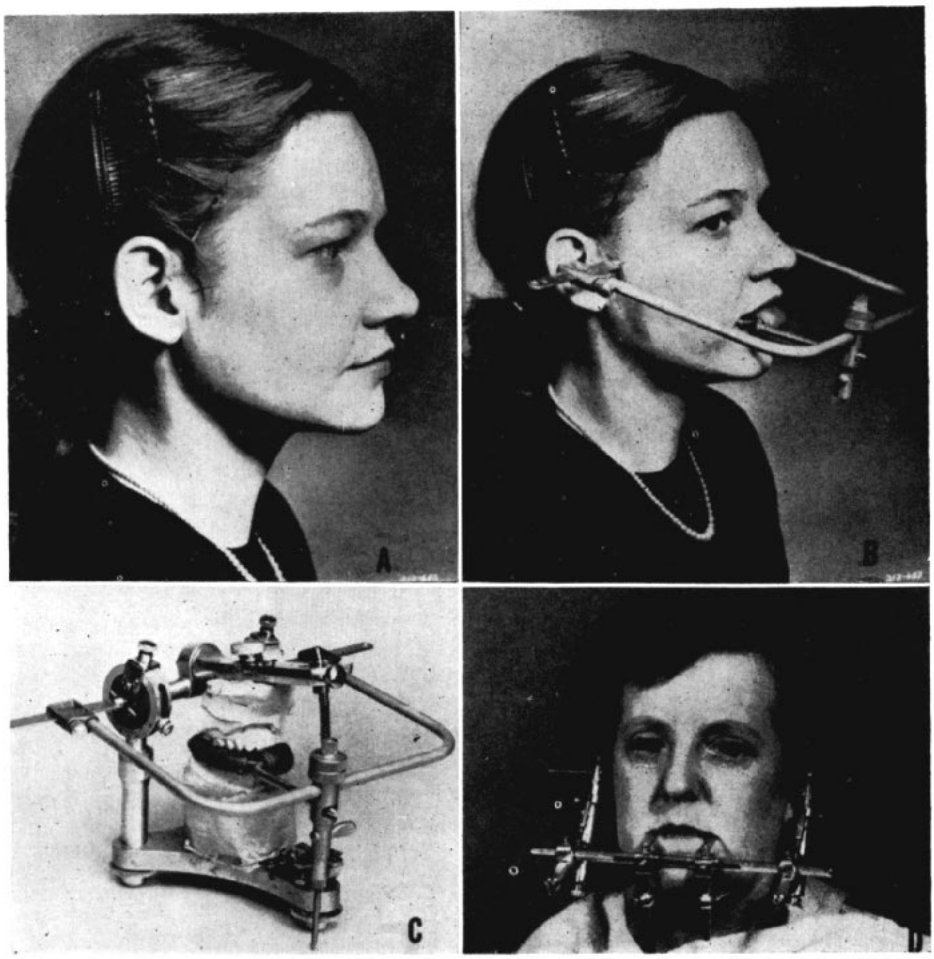

Fig. 1. A-B-C—Face bow transfer made from arbitrary point 13 mm. in front of ear hole. D—Hinge bow.
(Photos courtesy of Dental Digest and Transograph, Inc.)

and the posterior teeth were again out of occlusion, but not as much as when the rest position bite was used.

In order to understand at least one of the reasons that such results were obtained it is necessary to know something about the hinge axis. In 1926 McCollum originated a device called the hinge bow for locating the rotational axis of the condyles. Fig. 1D shows a hinge bow recently designed by Page. It resembles the face bow somewhat except that its arms are adjustable and instead of condyle rods there are finely pointed condyle pins. When this apparatus is clamped to the lower jaw, the patient opens and closes while the operator holds the jaw in retrusion. By carefully watching the condyle pins and using the various adjustments on the hinge bow, the position of the condyle pins are shifted until they cease to arc and begin to spin over a single spot.

After using the hinge bow on these two cases it was observed that the true

hinge axis was located back on the tragus of the ear fully one half inch away from the arbitrary points which were used before in making the face bow transfer. The axis of rotation on the articulator had not been made to coincide with that in the head in the previous mountings. Just as an experiment, several other face bow transfers were made using points one half inch in front, in back, above and below the true hinge axis. The same wax bite was used to relate the upper and lower casts in all mountings. Yet different results were obtained each time even though the wax bite was very thin. The error could not be completely eliminated when the points selected for the face bow transfer were as much as half an inch away from the true hinge axis. This is a source of error whether the rest position bite or retruded bite is used because there is great variation in the location of the hinge axis.

The next method is probably used more than any other to mount casts of natural teeth in the articulator. It consists of using the retruded bite in conjunction with a face bow transfer made from the hinge axis marks. This seems to be quite an accurate method providing the patient's mandible can not be retruded beyond the intercuspal position. However, such patients constitute only a small percentage of the adult normals. When this method of registration is used to mount cases that can retrude slightly beyond the position where they actually function the result is a retruded bite. The results are consistent but this does not necessarily mean that this is optimal jaw relationship. There are many who feel that this is an unnatural or strained position.

Mounting casts of normal occlusions according to these different methods without being able to make the teeth fit together as they do in the mouth is enough to discourage anyone from using an articulator to analyse an occlusion. It seemed that even though these were excellent occlusions the analysis indicated that some type of treatment was necessary, but it would vary according to the method used.

From this, one might gain the impression that neither the rest position bite nor the retruded bite is accurate as a mounting position in the articulator. Yet one or the other must be used. So in order to determine which, let us review two recent studies which may help to solve this problem.

In Ricketts laminographic xray study of the temporomandibular joint he found that in normal occlusions the condyle is well seated in the glenoid fossa and in close contact with the anterior slope of the fossa, both while the teeth are in occlusion and when the mandible is at rest. However, in Class II malocclusion there is a startling difference. In two thirds of the Class II cases studied the condyle hangs low in the fossa at rest, but in most cases is in the normal, well seated position when the teeth are in occlusion. The extreme Class II dysplasias of facial pattern showed the condyles almost at the summit of the articular eminence at rest with only a partial return of the condyle when the teeth are occluded. He states, "had it been possible for the condyles to seat full in the fossae in such cases, the mandibular arch would have been more than a full cusp *distal* to the Class II relation, a condition rarely seen in occluded models."[1] In speaking of the changes which should be brought about in such cases, he says, "it now seems probable that such changes must equal not only the discrepancy in molar relation but also the amount that the condyle must move to seat itself properly in the fossa."

In addition to this he found that the rest position changes as the occlusion changes. In the treatment of Class II,

Div. 1 malocclusions, as the upper anterior teeth are moved back, the rest position also moves back toward the well seated position. If the upper front teeth are moved forward as they are sometimes in treatment of Class II, Div. 2 cases the rest position moves forward. This behavior caused him to comment, "the evidence seems to indicate that the forward position of the condyle that was exhibited by two thirds of the Class II sample is a conditioned position or accommodation in the interest of respiration and speech."[1]

There were several other observations which led him to believe this. When upper anterior teeth protrude the function of incision is altered. The mandible is protruded beyond normal limits in order to establish incisal contact. Such patients must also bring the mandible forward in speaking in order to produce certain speech sounds such as B, P, and M. Also, many of these patients because of vanity make a sustained effort to conceal a malocclusion by covering the teeth with the lips. In all such cases the muscles which protrude the mandible, chiefly the external pterygoids, are overactive. The rest position then itself, is abnormal and is certainly not a reliable reference point from which to make an analysis, at least in this type of malocclusion.

What is known about rest position and retruded position in normal occlusions? Although Rickett's studies seemed to indicate that closure from rest to occlusion was rotational in normal occlusions there are other studies which seem to prove otherwise. Posselt of Sweden in his recent *"Studies in the Mobility of the Human Mandible"* made some interesting observations.[3] In his recordings of the mandibular capacity for movement he observed that when the mandible is protruded the path is a short curve as shown (Fig. 2). As the mandible opens while still in

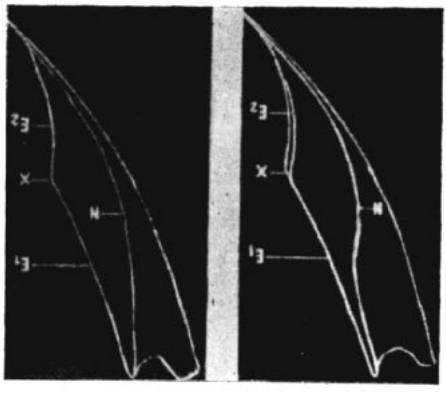

Fig. 2. Movement paths of mandible recorded in median plane. (from Posselt)

protrusion the path is a gradual curve. When the mandible opens or closes while retruding, the path is broken in the lower third of the stroke. From this point X to occlusal contact the mandible rotates about an axis somewhere in the condyle. This axial center of rotation in each condyle is called the hinge axis while the amount which the jaw can be opened on these axes is called hinge range. With a little practice the jaw can usually be opened twenty to thirty mm. or nearly two thirds of the total opening without the condyles coming forward. He made these graphic recordings on people who were conscious, also on patients who were anesthetized and injected with curare so that muscles would be completely relaxed; the same pattern was obtained for each method. Then he did the same thing on a cadaver after cutting away the muscles of mastication and the result was the same type of pattern. After cutting the temporomandibular ligaments the posterior path of closure was a gradual curve, the angle having disappeared and the movement area being somewhat larger. He states, "the fact that the movement paths which were recorded in the median and occlusal planes seem to be reproduceable from one registration to

another suggests that comparatively inelastic tissues limit these movements." He also says, "the experiment with the subject under anesthesia and in a state of muscle relaxation by means of curare seems to indicate that the external pterygoid muscles do not support the condyles in their retruded positions."

Posset's studies on rest position, which were done with head xrays showed that the rest position is nearly always between the border paths and very seldom on the posterior hinge path. There was also a great deal of individual variation in its location. As far as the retruded position is concerned he found that eighty-eight percent of the normals could retrude an average of 1.25 mm. beyond the intercuspal position, and at small degrees of bite opening these two positions coincide very closely.

Therefore he states, "the rest positional relation is therefore in my opinion impractical as a mounting position in the articulator, and is so for the following reasons: the movements of the condyles when the mandible shifts from the rest position to the intercuspal position do not seem to be so simple as originally supposed. My registrations of the mandibles' shift from the rest position to the intercuspal position show such a great individual variation that reproduction in an individually adjustable articulator must presumably become more difficult and doubtful than that of the posterior hinge movement." He admitted however, that his method may not have been completely reliable because it is difficult to measure such small movements accurately from head xrays. Nevertheless the doubt is there. Even in normal occlusions there probably is a certain amount of translational movement of the condyle from rest to closure.

There is an other observation which indicates that movement of the condyle from rest to occlusion is translational even in normal occlusions. When the hinge bow is clamped to the lower jaw and pressure is applied to the chin in a backward direction one can observe that the condyle pins always travel upward, or upward and forward, never backward. The amount of movement is small, only a millimeter or so in most cases. In view of Posselt's work one might reason that it is the temporomandibular ligament which guides the condyle up against the anterior slope of the fossa. It seems reasonable to conclude that the retruded bite is much more reliable than the rest position bite if condyles are to be properly seated in the fossae. There is only one difficulty to be overcome. The great majority of adults can retrude the mandible beyond intercuspal position. In transferring such a case from the mouth to the articulator how is one to avoid this retruded strained relationship and still feel sure that condyles are being properly seated in the fossae?

This brings us to another method of registration which has recently been devised by an engineer and a dentist. This method involves the use of the hinge axis registration, the retruded bite and a new instrument (Fig. 3) which operates on an entirely different principle than articulators in common use today.

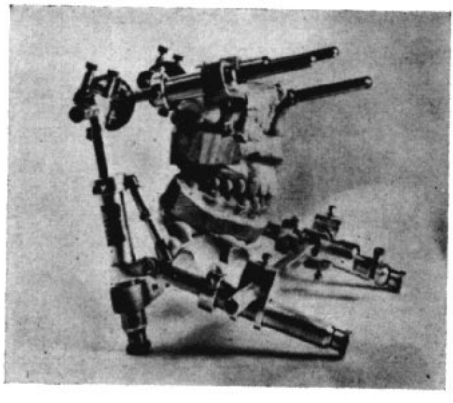

Fig. 3. Photo of Transograph from Dental Digest.

Whereas the conventional articulators are rigid, and the opening and closing movement takes place around an intercondylar hinge axis the new instrument is flexible and operates on a separate axial center of rotation in each condyle. It must be assembled piece by piece to fit each individual patient.

In order to test this method, patients with normal occlusions (such as shown in Fig. 4) were selected who could retrude the mandible slightly beyond the position where they actually function. Comparisons were made between mountings on the conventional adjustable articulator and those on the new instrument. The casts were first mounted in the conventional articulator by registering the hinge axis and then making the face bow transfer relating the upper to the lower with the retruded bite. Here is an example of the results which were obtained in each case (Fig. 4EF). Notice that the retruded relation is reproduced in the mounting. If analysis were made from this mounting the treatment would very likely involve occlusal grinding. But in view of the fact that this patient is forty years of age and has no peridontal or joint trouble it seems doubtful that occlusal interferences are present. However, when the same casts are mounted in the new instrument (Fig. 4GH) using the hinge axis registration and the same wax bite, the upper and lower teeth fit together in a good cusp and groove relation. If analysis is made using this method no occlusal adjustment would be necessary. To date only five cases have been compared in this way, but each time the results were the same.

Another case in which comparative mountings have been made is illustrated in Fig. 5. Several years ago this person received occlusal grinding to relieve socalled interferences in the molar area. His casts were mounted in the articulator using face bow transfer and retruded bite. Grinding was done first for centric and then for lateral excursions. Now several years later he has the same socalled interferences as before. At no time has any periodontal destruction been observed. Figure 5EF shows the relation between upper and lower casts when they are mounted on the Dentatus articulator. If analysis were made from this mounting he should receive occlusal grinding again. The casts are mounted in the Transograph in Fig. 5GH. This mounting showed a very slight trace of interference, but it was too small to photograph. In order to realize it was there one would have to hold the instrument and feel it. For all practical purposes these teeth fit together with a good cusp and groove relationship just as they do in his mouth and it seems doubtful that occlusal grinding should ever have been done. Such instability has also been observed in other cases which have received occlusal grinding in this position of extreme retrusion.

Why is it the two instruments produce such different results? It seems that the new instrument takes into consideration the fact that most heads are asymetrical and that the condyle and fossa may be differently shaped on one side than the other. In the head, when one condyle is higher, lower, anterior or posterior to the other or of different shape than the other, the radius from one condylar hinge axis to the symphisis will be different from the radius on the other side. This means that there will be collateral compensating movements which cause a bodily shift of the entire mandible during opening and closing. Until recently this shifting, which is called Bennet movement, was held to occur only in lateral motion.

In order to illustrate the mechanical equivalent of Bennett movement, two wire jaws were constructed one of which is asymmetrical in the vertical

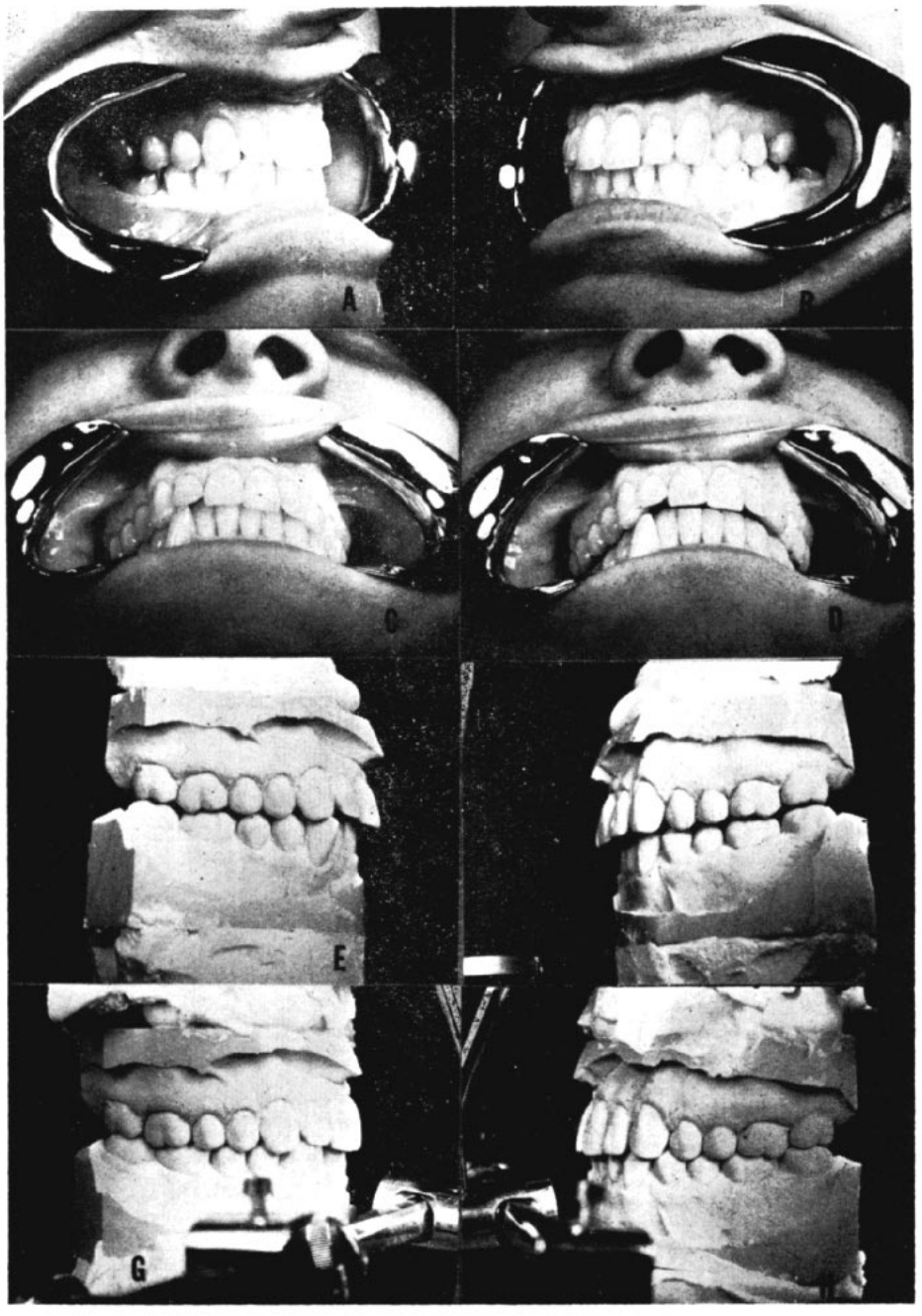

Fig. 4. A-B-C-D—Intra-oral photos of normal occlusion.
E-F—Mounted on Dentatus — face bow transfer from hinge axis marks-retruded bite.
G-H—Mounted on Transograph.

Fig. 5. A-B-C-D—Normal occlusion.
E-F—Mounted on Dentatus, face bow transfer from hinge axis marks-retruded bite.
G-H—Mounted on Transograph.

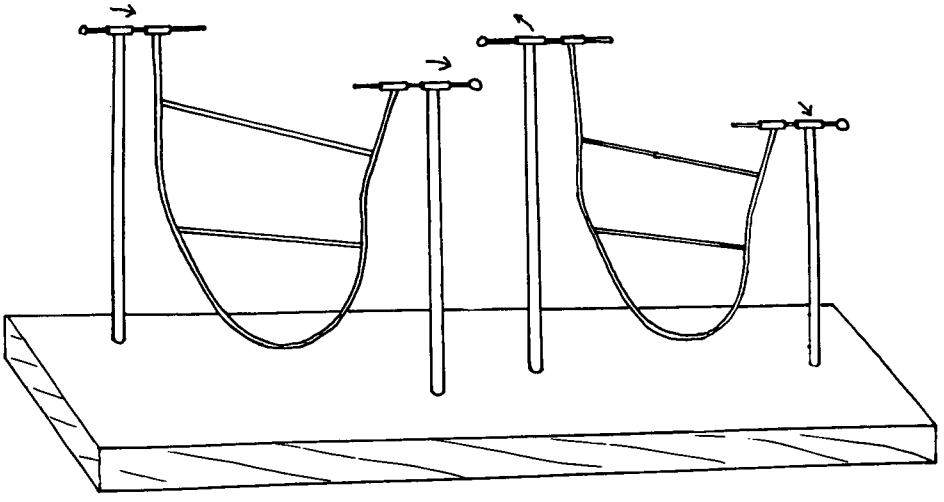

Fig. 6. Drawing of asymmetrical wire jaws to illustrate Bennet movement on opening and closing.

plane, and the other in the horizontal plane. These are illustrated by the drawing Fig. 6. When one joint is higher than the other the closing of the jaw will cause a backward shift of one joint and a forward shift of the other. However, when one joint is ahead of the other, the closing of the jaw causes a side shift of both joints in the same direction. There are many combinations of vertical and horizontal asymetries which cause more complicated Bennett movements. Even though these movements are small they can be very important in relating such complicated surfaces as occlusals of teeth. The use of this instrument also makes one realize the errors that can be made in taking retruded wax bites. When only one bite is used it is impossible to know whether or not it is correct. One must take several bites within a range of vertical opening to be sure. It is impossible to make such a test with instruments in common use today because they will not accurately duplicate the opening and closing posterior hinge path.

What proof is there that these movements actually occur in the head? They can often be observed while the hinge axis is being registered by watching the movement of the pins on the hinge bow. There is other evidence. Suppose one were to mount casts on a Dentatus or Hanau articulator using the face bow transfer on the hinge axis marks and the retruded bite to relate the upper cast to the lower. Theoretically it would be possible to take wax bites of different thicknesses within hinge range and they should all fit the mounted casts perfectly. But this cannot be done. The only one which will fit is the one which was used in the mounting. However, if the casts are mounted on the Transograph it makes no difference if the wax bite is thick or thin provided hinge range has not been exceeded.

Analysis of Treated Class II Malocclusions

The cases selected for analysing were all Class II malocclusions which were treated to what most men would consider a clinically successful result. That is, arch alignment is good, overbite is acceptable and molar relationships appear to have been properly corrected.

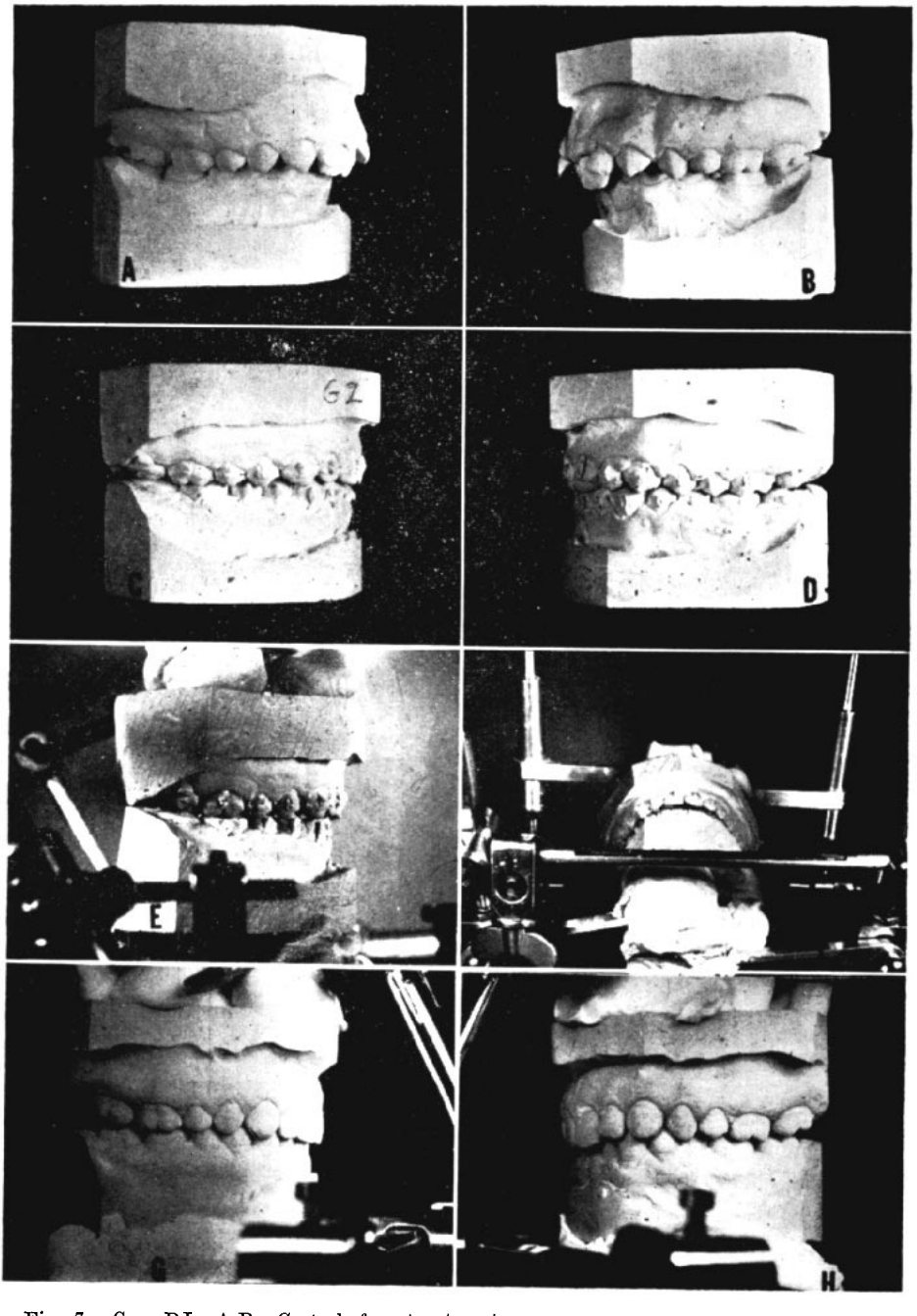

Fig. 7. Case BJ—A-B—Casts before treatment.
C-D—Prior to retention.
E-F—Mounting shows cusp to cusp relation.
G-H—Mounted two years later — cusp and groove relation.

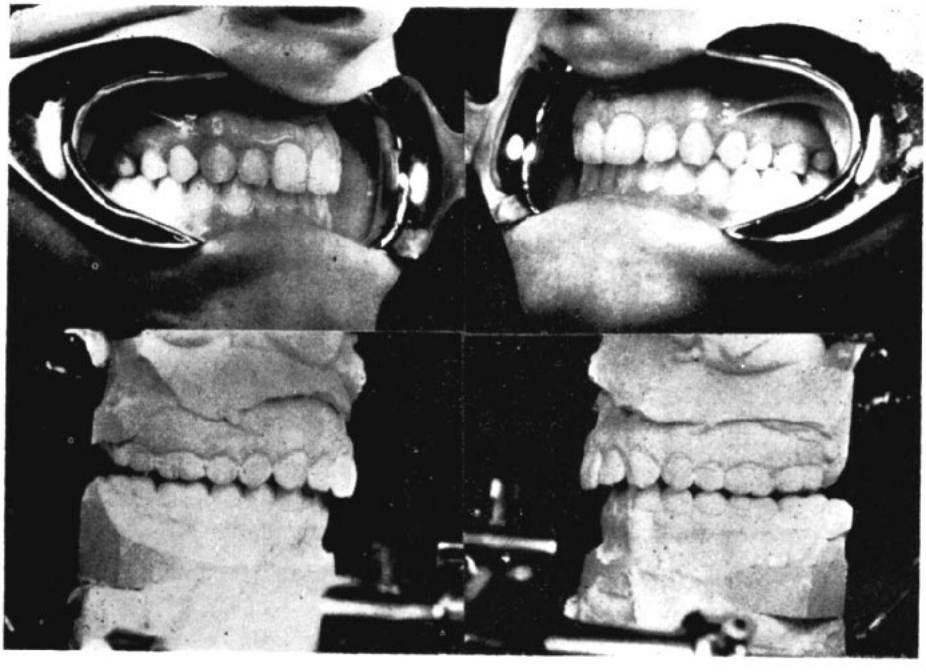

Fig. 8. Case BW—Upper—Class II, Div. I after treatment.
Lower—Mounting shows end to end molar relation right and Class II left.

To date fourteen cases have been analysed with the new instrument, but only those which best illustrate several points will be shown.

The first case (Fig. 7AB) is that of a boy with a severe Class II, Div. 2 malocclusion. He had an extremely deep overbite and the lower arch was completely lingual to the upper. The casts were mounted on the transograph just before the appliances were removed. In natural closure there was a good cusp and groove relation of buccal teeth (Fig. 7CD), but he could retrude his jaw much more than normal. The mounted casts show an end to end or cusp to cusp relation of molars and bicuspids (Fig. 7EF). This case started to relapse shortly after appliances were removed because of lost and broken retainers; it was corrected again with a short period of treatment, and a headgear was worn every night for about one year. Shortly after this it was observed that he could no longer retrude his mandible as far as before. He was checked at three month intervals until just recently. Two years later, at age seventeen, this patient can no longer retrude his mandible beyond intercuspal position, and the mounted casts (Fig. 7GH) show a cusp and groove relation of buccal teeth. Apparently growth has corrected this case to a more desirable jaw relation. Headcap during the retention period may have been partly responsible but the change was not observed until after the headgear was discontinued. This experience indicates that occlusal grinding after treatment is inadvisable until growth is nearly complete.

Fig. 8 is another case which looks like an acceptable result, but according to the analysis is far from ideal. This was originally a Class II, Div. 1 malocclusion. The mounting shows a cusp to cusp relation of the buccal teeth on

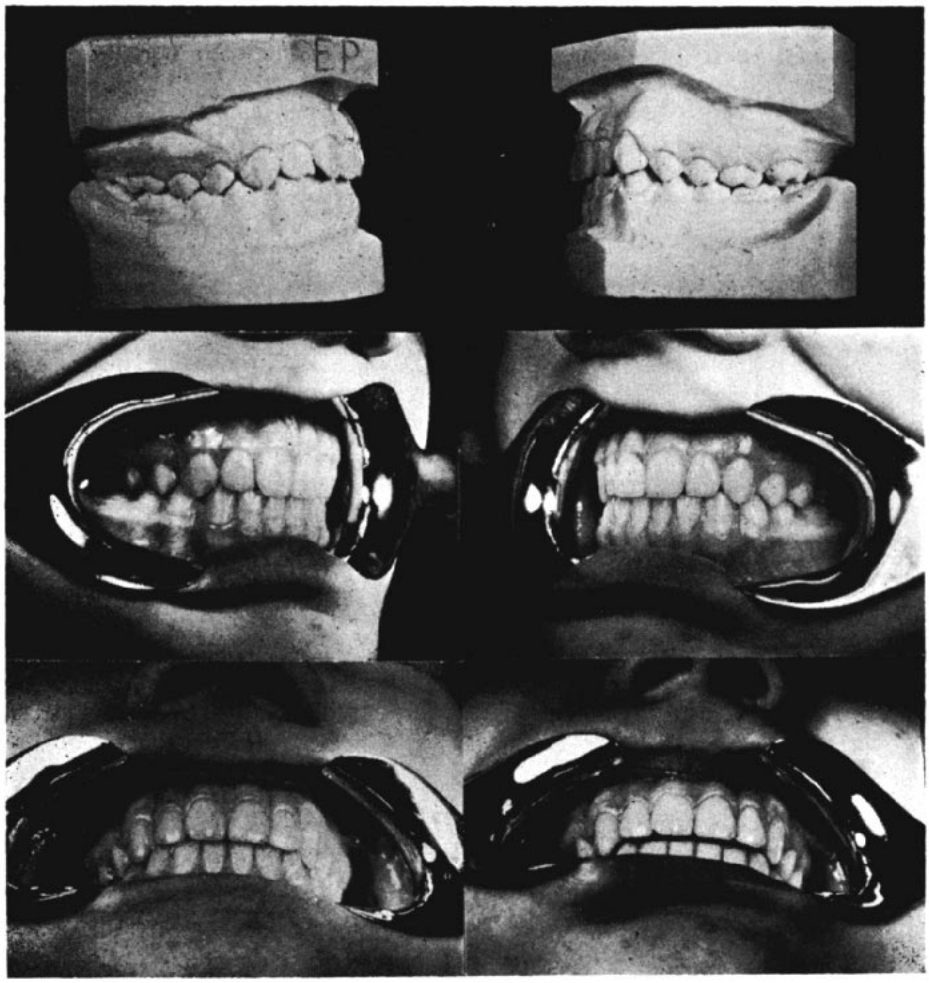

Fig. 9. Top—Class I relation right, Class II — left.
Center and bottom—Intra-oral photos after treatment.

one side and a Class II relation on the other. In other words the mandible is functioning further forward on one side than the other. Apparently orthodontic treatment succeeded only in repositioning the mandible while teeth were moved a slight amount. This patient is now only fourteen years of age so it is possible that jaw relationship may improve, but there is also the possibility that it may not improve because several have been observed that did not change for the better. Observations like these suggest that it might be better to remove upper biscuspids in some Class II malocclusions and not rely too heavily on favorable changes due to jaw growth. It is often possible to come close to the ideal in jaw relation by extracting upper biscuspids in some Class II malocclutions, but even when all precautions are observed to prevent forward movement of upper buccal teeth during space closure it is not always possible to attain perfection.

The next case is a unilateral Class II

malocclusion. Figure 9 (top) shows normal molar relation on the right side and a Class II relation on the left side. Figure 9-center, bottom shows the intra-oral photos after treatment. When the casts were mounted on the instrument it was observed that the left side was still slightly Class II while the right side which was originally Class I was good. This is a characteristic which has been observed in many of the treated Class II cases which have been analysed in this way whether they were unilateral before treatment or not. This patient was seventeen years of age and had been out of retention for two years so a slight amount of spot grinding was done first on the casts then in the mouth.

Figure 10 (top-center) shows another Class II, Div. 1 case before and after treatment. Here again occlusion appears to be normal. His mandible could be retruded slightly beyond intercuspal position, but the instrument did not

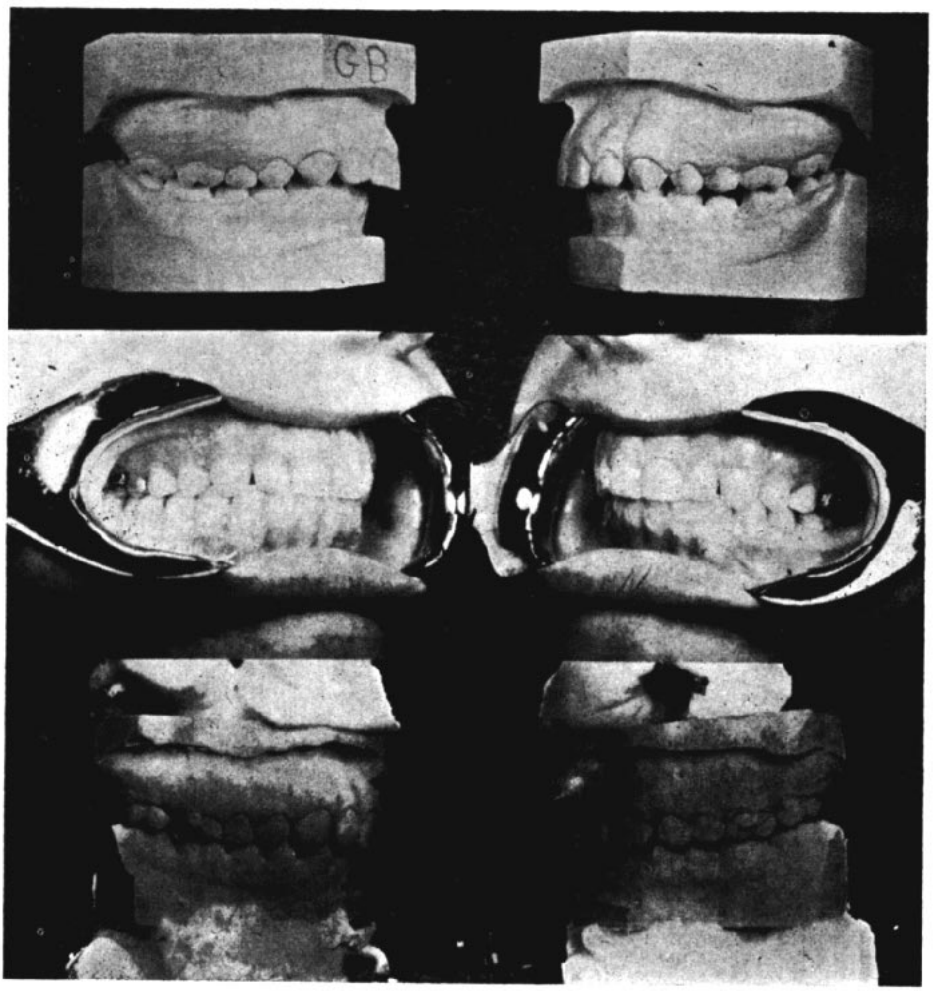

Fig. 10. Top—before treatment.
Center—after treatment.
Bottom—Mounted casts show relationship not quite as good as it appears to be.

bring his teeth into a cusp and groove relation (Fig. 10-lower) as it did when normal occlusions were analysed. After making occlusal adjustments on the casts it was felt that too much grinding would be necessary so this patient is now being checked at three month intervals to observe any changes that might occur.

Out of the fourteen treated cases analysed only four were considered in need of no occlusal adjustment. However, occlusal grinding was done only for three cases and they were over seventeen years of age. The others are being checked periodically to observe any changes that occur. No attempt was made to attain balance in lateral excursions because there is good evidence that such balance is not essential. Jankelson has shown that there is no such thing as cuspal guidance in mastication because the teeth do not come into occlusion during this function. It is conceivable that lateral balance may be important in patients with bruxism, but this is not normal function. There are many prosthedontists who now make no effort to balance their cases in lateral excursions. They pay such strict attention to the opening and closing movement that they are able to use very steeply cusped posterior teeth in their dentures with outstanding success.

Discussion:

Let us consider what constitutes the ideal in jaw relationship. If one can judge from the analysis of only a few normal occlusions it would seem that jaws are properly related when the intercuspal position is on the posterior hinge path. This is not the path which is being duplicated on conventional articulators and this path does not necessarily coincide with the most retruded position. Posselt observed that in most normal adult occlusions the mandible could be retruded slightly beyond the intercuspal position so he felt that it was not always on the posterior hinge path. Analysis of normal occlusions with an instrument which is believed to accurately duplicate this path showed that the teeth fit together with a good cusp and groove relation whether the mandible could be retruded beyond intercuspal position or not. This indicates that it is the posterior hinge path rather than the retruded position which should be used in analysing an occlusion. Until recently however, this path has not been accurately duplicated because dentists have failed to consider the effects of slight asymmetries which caues a bodily shift of the entire mandible on opening and closing.

In emphasizing the importance of an accurate posterior hinge path there are several points concerning mandibular function which should be considered. It has been contended by some that the mandible operates on the border path during mastication rather than within the border limits. However, Jankelson has shown that the mandible is in protrusion much of the time during mastication particularly when chewing highly resistant foods. Only in chewing of soft foods does the mandible approach the centric relation. The external pterygoid is well coordinated with the closing muscles in the closing stroke during mastication so it seems safe to say that this function takes place within the border limits.

During deglutition the teeth do come into occlusion with considerable force and, as Jankelson has shown, the mandible is normally in retrusion as it closes during this act. It is apparently during swallowing that the mandible is on the posterior hinge path, at least in small degrees of bite opening. It is probably the temporomandibular ligament rather than the external pterygoid which supports the condyle in its well seated position on the anterior slope of

the fossa in the act of swallowing. This is the time when the mandible closes with a lever-like action. Support is needed in the denture area and a fulcrum is needed in the joint during these strong and frequent muscle contractions and since the resultant direction of muscle pull is upward and backward roughly parallel to the fossal slope the mandible receives the necessary support without great pressure being exerted on joint tissues.

Some have advocated making occlusal corrections without using an articulator. To determine points of interference a piece of thin wax is molded over the teeth and the patient is instructed to close with the teeth in retrusion. It is then observed that high spots may appear, not on occlusal surfaces, but on the buccal of the lowers and the lingual of the uppers. These spots are then relieved so that occlusal surfaces rather than lateral surfaces receive the biting stress. This may be adequate for some cases but it seems important to first make sure that centric is properly located. It has been shown that retruding the jaw as the patient closes is not a reliable test for correct jaw relationship in many adults. Such retrusion often places the mandible in a strained position which is not stable. If one is to avoid needless occlusal grinding it seems advisable to use an instrument which accurately duplicates the posterior hinge path, particularly where the retruded and intercuspal positions do not coincide.

As far as orthodontic patients are concerned it appears that forcing the jaw posteriorly as the patient closes is a fairly accurate test for correct jaw relationship. The author has examined nearly one hundred children between five and fifteen years of age and observed that the teeth usually fit together perfectly in the retruded position whether a malocclusion is present or not. This tendency for the retruded and intercuspal positions to coincide in children should not be overlooked. It is undoubtedly impossible to treat all cases to such perfection, but there is good evidence that this should be the objective.

It seems doubtful that damage to the dental apparatus is inevitable merely because this ideal is not attained. It is known that muscle groups can operate with more than one set pattern of contractions. For example, it is considered normal for the teeth to come into occlusion during deglutition, but many children and probably many adults swallow without bringing the teeth together. If occlusal relations are not ideal in such cases the teeth and supporting tissues would probably be less likely to suffer because the teeth seldom come into occlusion with great force.

Even if deglutition is normal it seems probable that some individuals can tolerate intercuspal positions which are more forward than the ideal. In Fig. 11 are the intraoral photos of a person about fifty years of age who can retrude his mandible much more than normal. When the casts were mounted on the instrument the teeth were related just as they are in his mouth when he retrudes. This patient received orthodontic treatment for a Class II malocclusion when he was about thirteen years of age. Originally the upper cuspids were blocked out so the expansion necessary to bring them into line may account for the gingival recession around these teeth. He has lost several teeth due to caries and the remaining teeth show a great deal of wear but other than this he appears to have a healthy mouth. There is no periodontal destruction and no joint trouble. One possible reason that such a patient suffers little or no difficulty is that muscular coordination is good.

Another possibility concerns the shape

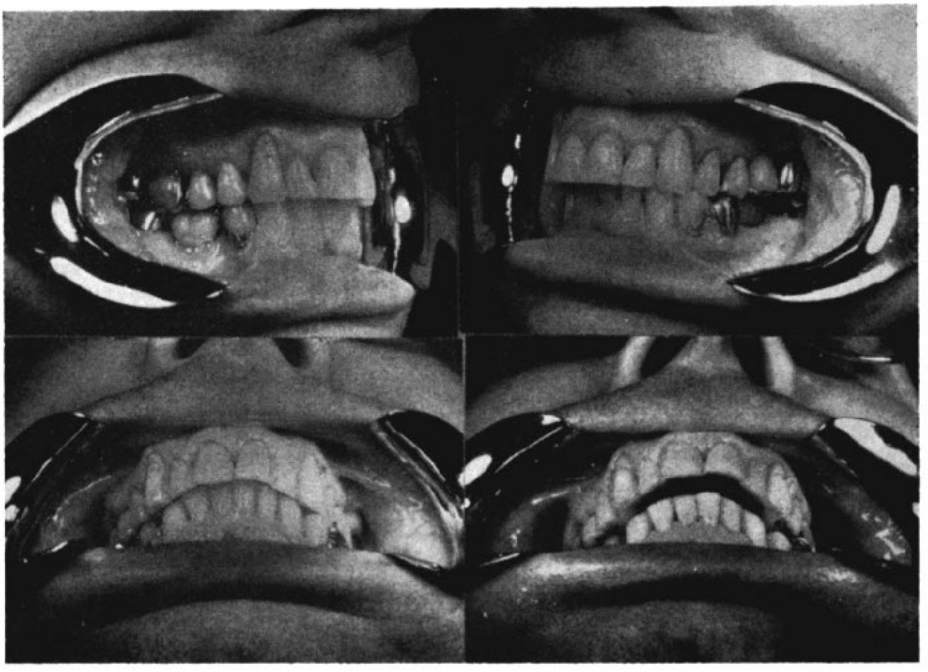

Fig. 11. Photos of fifty year old patient who received orthodontic treatment at age thirteen. Mandible can be reduced more than normal.

and size of the condyle in relation to the fossa; it is known that some condyles are large in proportion to the size of the fossa while others are small and also that there is variation in the inclination of the anterior slope of the fossa. If the condyle is small and the fossa quite shallow and muscular coordination is good it seems probable that the mandible could be trained to function more forward than normal without damage to the dental apparatus. It should also be recognized that such ideal conditions do not always exist and that some patients cannot function within a range of anteroposterior positioning without ill effects. Therefore, it seems important to have the functional ideal in mind and strive to attain it in every case.

Summary and Conclusions

1. Attention has been called to the fact that analysis of occlusion with conventional articulators has many shortcomings. Several methods of mounting casts of normal occlusions were used and results were different with each method.
2. The most accurate method involves the use of the hinge axis registration and the retruded bite with an instrument which operates on the principle of an axial center of rotation in each condyle rather than an intercondylar hinge axis.
3. The position of extreme retrusion which is so commonly used in restorative dentistry, and which is duplicated in conventional articulators by registering the hinge axis and using the retruded bite is not a stable position for many individuals.
4. Analysis of treated Class II malocclusions reveals that jaw relationship sometimes changes after treatment, probably due to growth. Therefore, occlusal grinding does not

seem to be indicated at least until growth is nearly complete.

5. This analysis indicates that even the cases which appear to be well treated may not be like normal occlusions. Class II treatment often results in repositioning mandibles forward even though precautions are taken to avoid it and, furthermore, mandibles are sometimes being made to function farther forward on one side than the other. Jaw relation is often more ideal before treatment than after treatment. However, there is evidence to show that some individuals can tolerate mandibular positions which are slightly more forward than the ideal.

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