# The Application of the Principles of the Edgewise Arch in the Treatment of Malocclusions: II.*

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THIS PAPER will deal with the application of the principles of the edgewise arch in the treatment of malocclusions. I shall attempt as thorough an analysis of the principles involved in treatment as the time allotted will permit, as an aid to those of you who are interested in this mechanism.

The last of Angle's many mechanical contributions to orthodontics, the edgewise arch mechanism, is unquestionably a great improvement over any previous appliance designed for the treatment of malocclusions. Refinement may be possible in the future, but it is difficult to conceive of improvement in this appliance so far as mechanical principles are concerned.

To me it seems futile even to hope to standardize treatment with this or any other mechanism, because experience and experiment have proved that no two individual operators ever visualize "the thing behind the thing" as a congruent picture. Moreover, we rarely find identical conditions involving even very similar malocclusions. Accordingly, treatment must vary somewhat.

Chuck,[1] Lasher,[2] McKenzie, and Steiner[3] have demonstrated that, unless guided by mechanical aid, all arch forms vary. (Fig. 1) No two of us have the same concept of the normal in this single step of treatment. We could scarcely expect the situation to be otherwise, because no two of us are identical. One has but to visit his brother practitioners to observe that the same condition holds true in all phases of operative procedure. Each has his own definite concept of the normal mesio-distal relationships of the jaws, of the positions of the individual teeth in relation to each jaw, and of the axial relationships of the individual teeth to the jaws and to one another. In other words, the mental picture of "the thing behind the thing"—balance, harmony, efficiency, and beauty—varies with each individual operator. The methods and results of treatment vary correspondingly. Thus the technical application of the principles of the edgewise arch mechanism in treatment is not identical in any two instances.

Ever present in the back of my mind is an image of the profile of a skull and a face, which to me represents the normal. (Fig. 2) One glance at an unbalanced face, or at teeth in malocclusion, and there is a comparison before

* I am deeply indebted to Mrs. Angle and Dr. Samuel J. Lewis for their generous aid in editing the first section of the paper. Were it not for Dr. Lewis's encouragement and deep interest and his able editing of the complete paper on treatment it could not have been published until a much later date.

[1] Chuck, George C. "Ideal Arch Form." THE ANGLE ORTHODONT., 4:312, Oct. 1934.

[2] Lasher, Matthew C. "Consideration of the Principles of Arches as Applied to the Dental Arches." THE ANGLE ORTHODONT., 4:248, July, 1934.

[3] Steiner, Cecil C. "Orientation of the Teeth and Dental Arches." THE ANGLE ORTHODONT., 4:35, Jan., 1934.

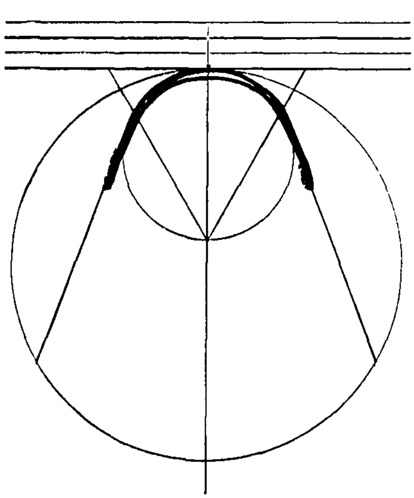



**Fig. 1.**—Showing the relation between the maxillary and mandibular arch wires.

me, as clear as any photograph could depict, between such a case and my concept of the normal. Some of you might say that the normal, as I envisage it, has a mandible that is slightly anterior to the true position in relation to the skull, and that the individual teeth in the mandible are a little too upright or vertical. It is true, the lower incisors and cuspids are so vertical that when ready for retention they might even give the impression of retrud-

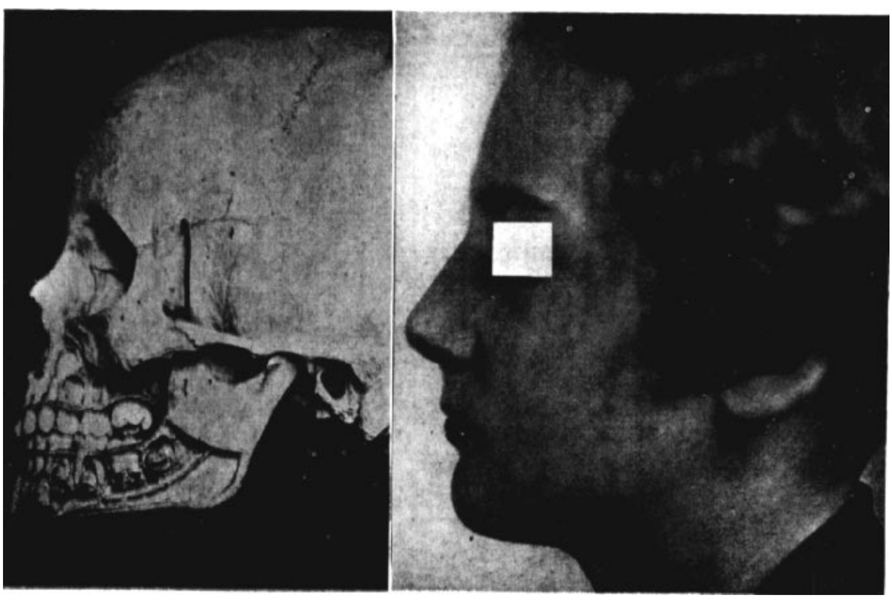
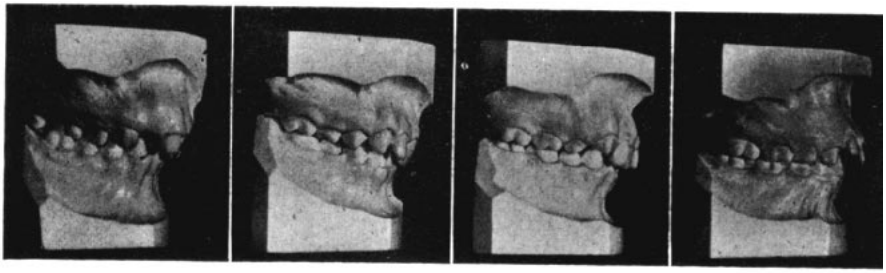


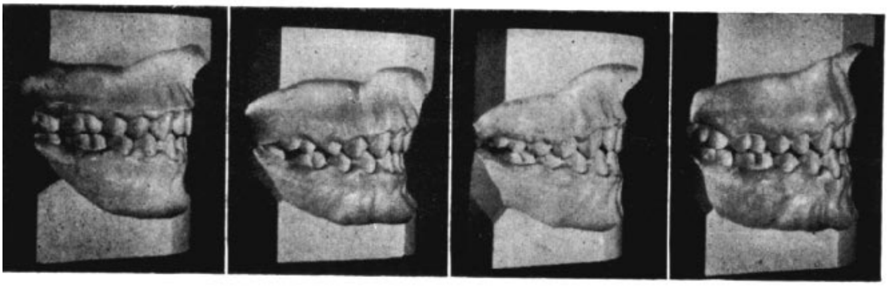
**Fig. 2.**—The writer's conception of properly placed lower incisors, and a balanced face (The skull is from the collection of Dr. Spencer Atkinson.)

ing slightly. There is no protrusion of the alveolar process in the lower incisal region, and the mandible is firm and prominent. Though differences of type should of course be considered, my vision of the normal allows of no variations; it seems a piece of precision machinery.

You have my confession now: I look with loving eyes on a prominent mandible. Occasionally, when nature has created my idea of the normal in some individual, my impulse is to pass my hand over it—to feel it so that I cannot forget it.



W-1 Z-1 C-1 T-1



W-2 Z-2 C-2 T-2

**Fig. 3.**—Upper models show cases before treatment, while lower ones show the treated cases. Note the incisors in the lower models have either been moved on to or maintained on the basal bone or ridge.

Do I always succeed in reproducing my mental concept of the normal? Not always am I entirely successful, but the similarity of relationships in my finished cases demonstrates the results of my efforts and shows how far I attain my goal. (Figs. 3 and 4)

Having attempted to describe the image, the concept, the goal, toward which all my efforts are directed, I will proceed with a discussion of some of the problems and techniques involved in the treatment of the various classes of malocclusions. For convenience, I shall follow Angle's classification, adding a fourth class, as follows:

The mechanics involved in the treatment of

1. Class I Malocclusions.
2. Class II Malocclusions.
3. Class III Malocclusions.
4. Bimaxillary or Double Protrusions.

## GENERAL PLAN OF TREATMENT

Treatment, in my office, is divided into three distinct steps:

*First Step:* A. Anchorage preparation in the mandibular arch in Class I and Class II cases and in bimaxillary protrusion cases. By anchorage preparation I mean the placing of the mandibular incisors up over the basal bone, or maintaining them on the basal bone, and rearranging the axial inclinations

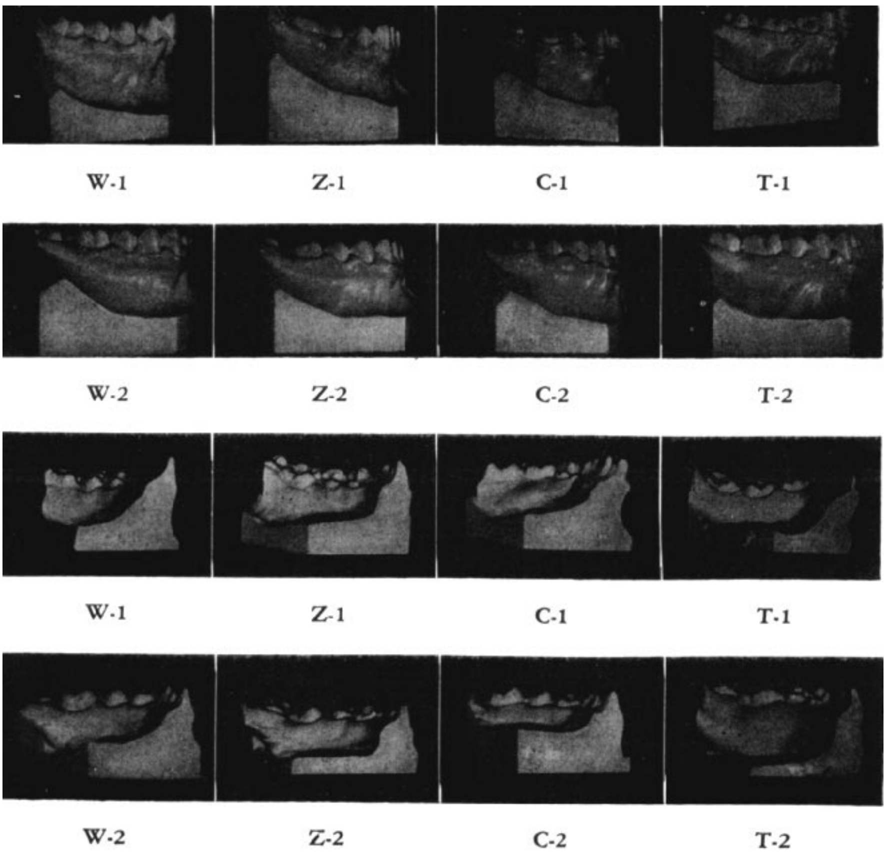



**Fig. 4.**—Series W-Z-C-T-1 represent the mandibular arches shown in Fig. 3 before treatment, while number 2's show the treated cases. The two lower rows show the same models in profile and how the mandibular incisors have been either maintained or moved on the basal bone ridge.

of the teeth in the buccal segments, from cuspid to second molar when possible, in such a manner as to create toe-hold to combat any tendency toward mesial drift of the teeth in the buccal segments when intermaxillary force is applied. When all the teeth are so positioned, a strong steel ligature is tied from behind the molar band sheath to a T that has been soldered on the arch wire just mesial to the sheath, thus binding all the teeth into a unit, preventing arch migration, and enhancing anchorage.

B. When necessary, the rearranging of axial inclinations in the maxillary arch, particularly in the incisal region of Class II, Division 1 cases, in such a way as to reduce their resistance to distal movements.

*Second Step: En masse* movements to correct jaw relationships.

*Third Step:* Detailed tooth positioning preparatory to retention.

Since my average period of active treatment is thirteen months, roughly four months are allotted to each of the three phases. I concentrate on parts A and B of the first step, forgetting about the second and third steps until the first is completed. Then for four months, I concentrate on the second step, watching the first step, but forgetting step three. When the second step has been accomplished I carefully observe the first and second steps and concentrate on the third, which has to do with the artistic positioning of all the teeth, further establishing ideal arch width and the seating of cusps prior to retention.

## CLASS I MALOCCLUSIONS

"Class I is characterized by normal mesio-distal relations of the jaws and dental arches, as indicated by the normal locking on eruption of the first permanent molars, at least in their mesio-distal relations, though one or more may be in buccal or lingual occlusion."[4] If, for any reason, there has been a

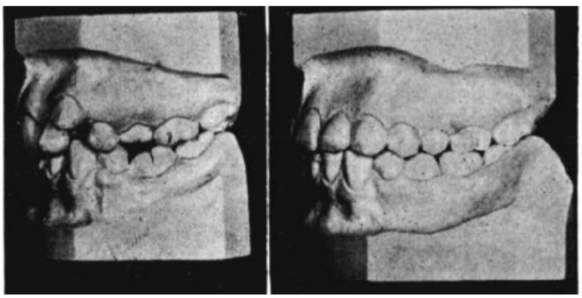


**Fig. 5.**—Class I malocclusion. Note that the lower first permanent molar has drifted mesially blocking out the second bicuspid.

drifting of these teeth, the extent of the drifting must be taken into consideration in diagnosis and treatment. (Fig. 5)

The great majority of Class I malocclusions that have come under my observation are in reality the beginning of bimaxillary protrusions. The overlapping of contacts, or the loss of tooth anatomy, which allows the teeth in the buccal segments of both the mandibular and maxillary arches to drift forward to any appreciable extent, or the lack of normal restraining influence in the orbicularis oris muscle in holding the denture back, will result in a malrelationship of the teeth to their respective jaw bones.

Some of these so-called simple Class I cases I have found difficult to retain after treatment. The individual teeth are too far forward in relation to their respective jaw bones, and the denture is therefore mechanically unsound and cannot withstand the forces exerted upon it incidental to function. The frequency with which it collapses, particularly in the lower incisal region, is, to say the least, alarming.

[4] ANGLE, E. H. *Treatment of Malocclusions of the Teeth*, ed. 7, Philadelphia, S. S. White Dental Manufacturing Co., 1907, p. 36.

## Treatment

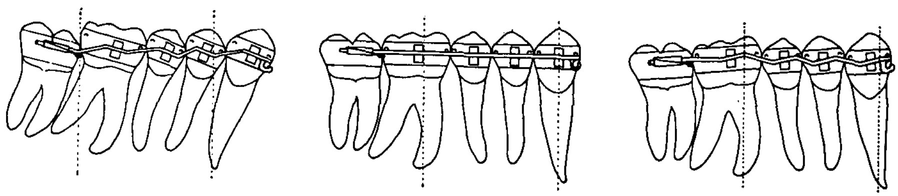
1. *The Mandibular Arch:* When conditions allow, molar bands are cemented to the second permanent molars; otherwise, to the first permanent molars. Tie bracket bands are made for all the teeth anterior to the anchor bands and then cemented in place. Each band carries a mesial and a distal staple. After a .016″ round steel wire is inserted, with bends to begin uprighting the anchor teeth, the case is dismissed for from ten to fourteen days, or until the patient has recovered from the discomfort occasioned by the initial tooth movements, which are usually quite painful. Here it might be mentioned that I use two types of round steel wires. If there are no spaces to be closed—that is, if all the mandibular teeth are in contact—I use a plain .016″ arch with tip-up bends to start uprighting the anchor teeth, but not tying it to the molar sheath. If, however, there are spaces between some of the mandibular teeth and I want to close them at once, I use either an .018″ or .020″ round arch into which I incorporate small loops about 1/8 inch mesial to the molar sheath, to act as stops. This arch is tied to the molar sheaths with a steel ligature in such a way as to bind the arch and close the spaces.

The plan of treatment should be to upright all mesially inclined teeth in the buccal segments of the mandibular arch, with as little forward displacement of their root apices as is possible, and with no forward displacement of the lower incisor teeth. They must be placed or maintained on the basal bone, as the case may be.

During the second visit, providing the crowns of none of the teeth in the lower arch are blocked out of the occlusal line to the extent of more than 2 mm., a lower ideal arch wire is made of .021″ x .025″ steel. It is necessary to have .001″ clearance between arch wires and our present accurate brackets. The arch wire is inserted into the molar band sheaths, and marks are made for all necessary stops and attachments. After soldering on the attachments, including intermaxillary hooks anterior to the cuspid brackets, the arch wire is again inserted into the molar sheaths and tested. It is marked, removed, and step-back bends, of a mild degree at first, are made from molars to cuspids, and a slight torque is incorporated into the incisal portion of the arch wire to torque the crowns of the incisors lingually, without appreciable movement in the apical region of these teeth, and without much displacement of the molar anchors. (Fig. 6C) The arch must be tied securely to the molar sheath to prevent any forward migration of the arch wire and to bind all the teeth closely together into a strong unit.

2. *The Maxillary Arch:* Following the same procedure as in the mandibular arch, molar bands are cemented to the second permanent molars when conditions allow; otherwise, to the first permanent molars. Tie bracket bands are cemented to all the teeth anterior to the anchor bands, and each band carries a mesial and a distal staple. After the correct .016″ round steel arch wire is inserted with the proper bends to start uprighting the anchor teeth, the case is dismissed for from ten to fourteen days, as in the case of the mandibular arch treatment. I always endeavor to place the mandibular and maxillary round arches at the same sitting, so as to co-ordinate the initial tooth movements and to get rid of the usual soreness in both arches.

At the time the .021″ x .025″ arch wire is placed in the mandibular arch,



A B C

Fig. 6.—A. Second order bends producing mesial crown tipping. B. Arch with no second order bends. C. Second order bends producing a distal tipping of the buccal teeth.

an .021" x .028" stabilizing ideal arch wire of steel is fashioned for the maxillary arch. The arch wire is marked and removed from the mouth. Tip-back bends are incorporated into the arch wire to kick the crowns of the anchor teeth slightly back. Very mild second order bends, just strong enough to prevent tipping forward of the teeth when Class III rubbers are used, are made in the arch wire in the regions of the bicuspid and cuspid brackets. A T or spur is soldered to the arch wire just anterior to the sheaths of the anchor teeth so that the arch wire can be tied to the anchor teeth to prevent any forward migration of the arch wire and to bind all the teeth closely together into a strong unit. Intermaxillary hooks of .028" brass wire are soldered to the arch wire anterior to the cuspid brackets.

Both maxillary and mandibular arch wires are then ligated into place and tied to the sheaths of the anchor bands.

## Head Gear

A head gear is made and the pull measured and checked. (Fig. 7) The pressure or distal pull of the head gear on the maxillary arch should be greater than the pull of the Class III intermaxillary elastics prescribed for the distal tipping or moving of the mandibular teeth. The patient is dismissed with instructions to wear the head gear at night in conjunction with strong Class

Fig. 7.—Head gear designed by Dr. Homer Sheldon. Credit must here be given to Drs. Milton Fisher and Paul Lewis for their design and use of the first head gear for anchorage preparation.

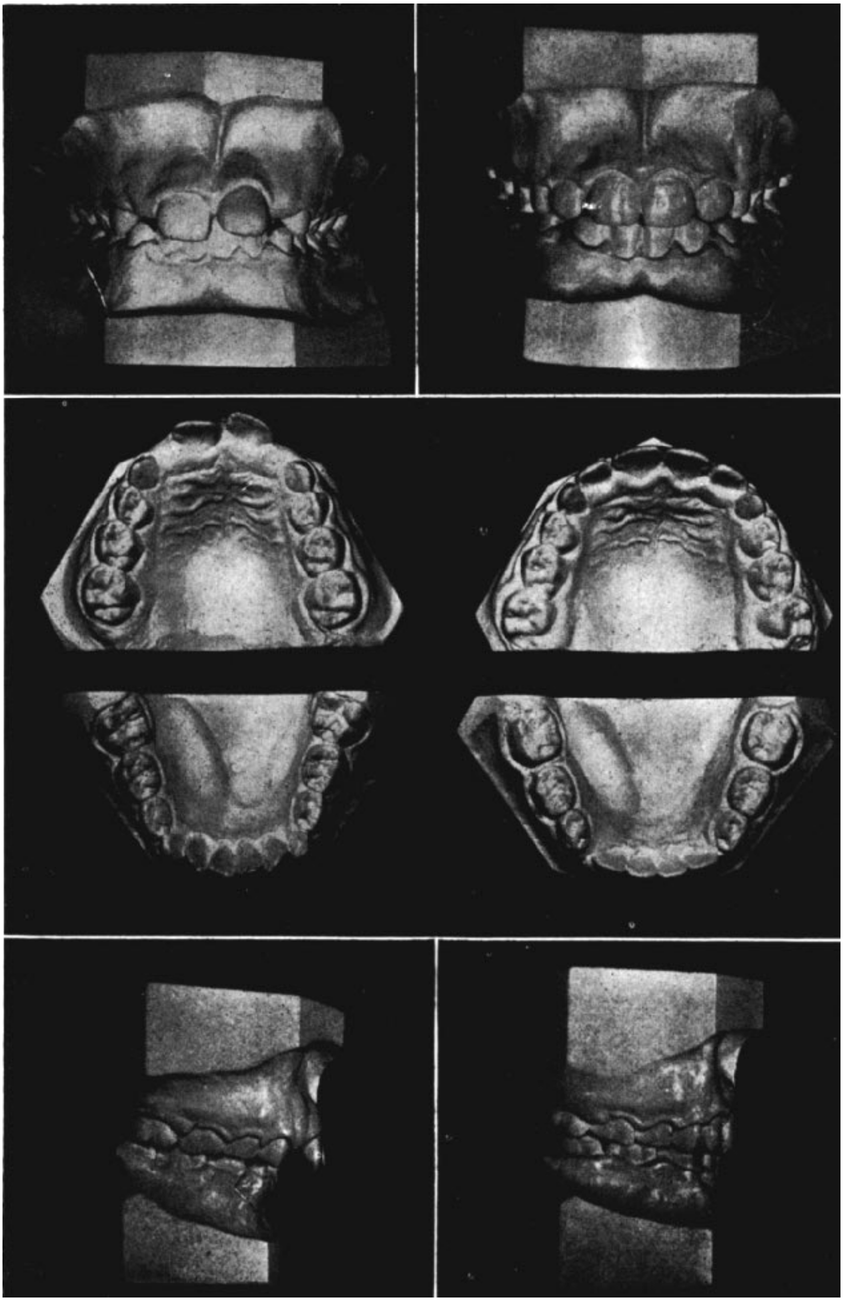


**Fig. 8.**—Mixed denture treated by extracting the mandibular deciduous cuspids to allow placing the protruding incisors over the ridge.

III elastics. During the day, when no head gear is worn, light Class III intermaxillary elastics are used.

By accentuating the second order bends and lengthening the mandibular arch wire at intervals of from two to four weeks, the teeth in the buccal segments are usually made vertical, and within four or five months enough space has been developed to accommodate all irregular and rotated teeth. The mandibular teeth also have been moved to or maintained in their proper relationship to their bony bases, without any appreciable forward displacement of the maxillary teeth. Thus anchorage preparation, or the first of the three steps in treatment, is concluded.

When all irregularities, including rotations, have been corrected, and normal arch breadth and form have been achieved, the maxillary teeth are often somewhat too far forward in relation to the mandibular teeth; that is, there is a deep overbite requiring further vertical development in the region of the buccal segments. The proper treatment in such cases is discussed under Class II cases.

## Treatment of Mixed Dentures

I have found the treatment of mixed dentures a perplexing problem. (Fig. 8) Black[5] and Hodgeboon,[6] Nance, and Lewis[7] at the Merrill-Palmer School have demonstrated that the combined widths of the deciduous cuspid and first and second diciduous molars are usually considerably greater than the corresponding widths of the permanent cuspid and first and second bicuspid teeth. The discrepancy varies from 1 mm. to 3.5 mm., and is usually greater in the mandibular arch than in the maxillary arch.

When these deciduous teeth are lost during normal growth and development, a compensation takes place. This must be true, for otherwise all contacts from molar to lateral incisor would remain wide open, which is usually not so. This closure of space therefore must be a normal growth and development process. Our treatment, if basically correct, should simulate this apparently normal process of space closure following the loss of the deciduous teeth and the eruption of the permanent teeth.

If orthodontic appliances are necessary, growth and development have not been normal. Neither are all these factors pertaining to growth and development functioning normally during the time appliances are worn, nor during the time the teeth are carrying fixed retainers or vulcanite plates. If during the treatment of these mixed denture cases we have maintained all the deciduous teeth without reducing their mesio-distal measurements by trimming, the distance from the first permanent molar to the lateral incisor obviously must be greater than is necessary to accommodate the permanent cuspid and bicuspid teeth. Either the molars are too far back or the incisal segments are too far forward. In my opinion, the latter is more likely to be true. If the case is retained in this condition the retainers prevent normal compensating tooth movements or adjustments.

In the treatment of these mixed denture cases I prefer to X-ray the teeth

[5] Black, G. V. *Descriptive Anatomy of the Human Teeth*, ed. 4, Philadelphia, S. S. White Dental Manufacturing Co., 1902.

[6] Hodgeboon, F. E. *Practical Pedodontia*, ed. 3, St. Louis, The C. V. Mosby Co., 1933.

[7] Personal communication to the author of this article.

carefully in order to determine the amount of space in excess of that necessary to accommodate the crowns of the permanent cuspid and first and second bicuspid teeth. (Fig. 9) The deciduous cuspid teeth are either trimmed to reduce their mesio-distal breadth, or extracted, as the need may be. The incisor teeth are then moved back to such a position as will allow just enough room to accommodate the permanent cuspid and first and second bicuspid teeth. They are held in this position pending the eruption of the permanent teeth. This procedure, I believe, substitutes as nearly as possible for the compensating factors that occur during normal processes and, as already pointed out, cannot take place during the wearing of appliances or retainers.

In mixed dentures that have suffered premature loss of teeth and space, one should not flare or displace the lower incisors forward in order to make space for an erupting cuspid, hoping later, in some mysterious way, to move them back again. Instead, reduce the mesio-distal dimensions of the first

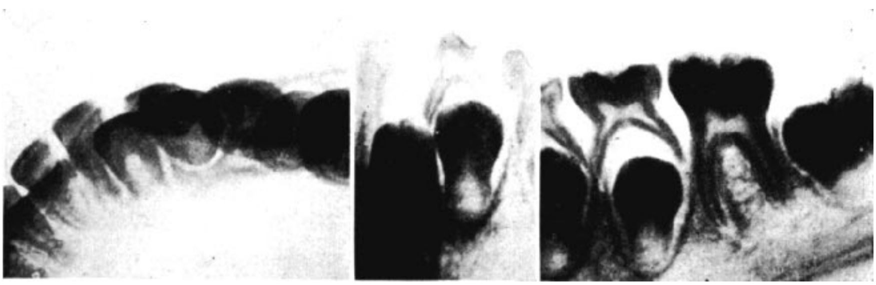


**Fig. 9.**—Roentgenograms of the mixed denture showing excess of space in the mandibular area compared to the size of the unerupted permanent canine and bicuspids.

deciduous molar, or extract it, and guide the erupting cuspid back at the expense of encroaching on the space for the incoming first bicuspid. If the cuspid can be guided into its normal position and banded, anchorage is greatly increased, and we have something with which to work. If necessary, this procedure may be repeated, and the second deciduous molar extracted to allow the first bicuspid to erupt in its approximate position, even though the space for the second bicuspid is jeopardized.

When the incisors, cuspids and first bicuspids are in good positions, there is sufficient anchorage available, if intelligently used, to move the molars back enough to gain necessary space for the second bicuspid without appreciably displacing the anterior teeth forward into protrusion.

When I say there is sufficient anchorage available if intelligently used, I have in mind the vertical spring loop as described by Strang,[8] with the necessary second order bends in the first bicuspid and cuspid region, in conjunction with Class III mechanics and the head gear I have described. The correct application of these forces will prevent the forward displacement of the anterior segment as the force in the loop develops the necessary space for the second bicuspid tooth.

To activate the loop without disturbing anchorage by repeated arch wire changes, a staple is soldered to the end of the arch wire that protrudes

[8] Strang, R. H. W. *Textbook of Orthodontia*, Philadelphia, Lea & Febiger, 1933.

through and beyond the molar sheath. The application of the ligature-tying pliers to a strong steel ligature wire, which has been threaded through the staple and around the anterior end of the molar sheath, between arch wire and molar band, will draw the posterior end of the arch wire forward, compressing the loop. In other words, the molars are moved distally.

In all Class I cases, ample breadth of the dental arches is desirable in order that the denture be made as non-protrusive as possible. For those types of cases in which a tooth or teeth are completely or partially blocked out of the dental arch, I prefer to use a steel arch wire, either .021″ round or .021″ square, into which one or more vertical spring loops have been incorporated. (Fig. 10) The number of loops used will depend upon the number of teeth blocked out. If the loss of space is in the buccal segment, in the region of the second lower bicuspid, for instance, the loop is made anterior to the molar

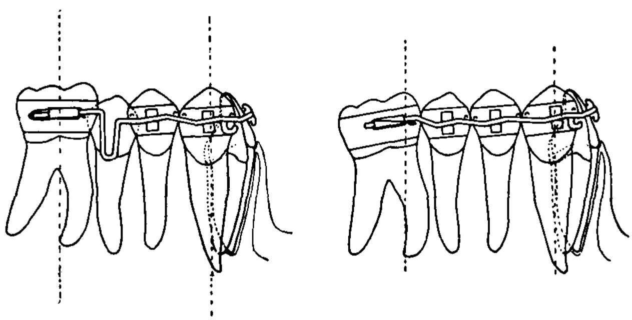


**Fig. 10.**—Use of the Strang vertical loop in opening a space for a blocked out mandibular second bicuspid.

or anchor tooth. Step-back bends are made in the buccal segments of the arch wire in such a way that when it is seated into the brackets of the first bicuspid and cuspid teeth, the force applied will tip the crown of these teeth back and their root apices forward, creating toe-hold to overcome the tendency to dislodge them forward, rather than move the molar back.

A stop is soldered to the arch wire just anterior to the cuspid or bicuspid bracket. A steel ligature wire correctly tied to the stop prevents any forward movement of the arch wire through brackets. To combat further any tendency toward protrusive movements in the incisor segment mild torque[9] is placed in the arch wire of such a nature that the crowns of these teeth are tipped back lingually. In addition, a bend is made in the arch wire immediately in front of the sheath of the molar anchor on the opposite side of the arch. The section of the arch wire posterior to this mark is bent in or towards the median line. When the arch wire is inserted into this molar sheath, the tendency will be to rotate the mesial of the anchor tooth buccally and the distal of the tooth lingually. (Fig. 11)

The resistance of the anchor tooth to rotation creates a distal force in the buccal arch wire segment on the opposite side which is conveyed to all the teeth ligated to it. This additional force supplements the anchorage being used by these teeth in moving the molars back in order to regain the lost second bicuspid space.

[9] The exact nature of this torque is described later in this paper, page 36.

This last-named force is probably a minor one. Bear in mind, however, that the primary object of good orthodontics is more than mere tooth alignment. Every vestige of anchorage should be utilized in order to combat and prevent protrusive movements which are always undesirable. Should the second bicuspids be blocked out of the arch on both sides, utilize the above method first on one side and then on the other, in order to take advantage of maximum anchorage and minimum displacement of the anterior teeth. These mechanics are supplemented with the head gear and intermaxillary pull, as described under the treatment of mixed dentures that have suffered loss of space.

In favorable instances, I believe it is safe to open up these spaces on both sides of the dental arch simultaneously. If this is done, the head gear and

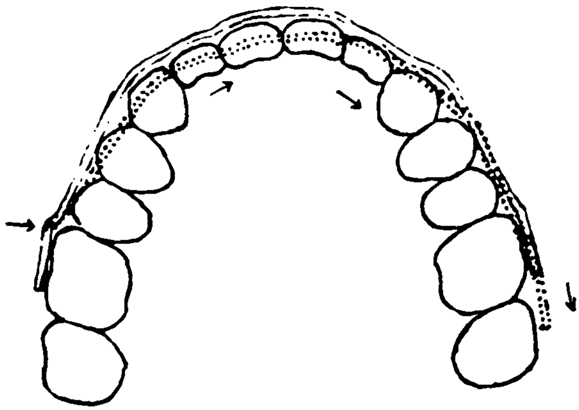


**Fig. 11.**—Author's method of bending arch wire to produce distal pressure to assist in opening spaces unilaterally. Dotted lines show arch bent properly.

Class III intermaxillary force should be used to prevent forward displacement of the teeth anterior to the loops. The arch wire, as I have stated, should not be removed more often than is necessary, so that anchorage will not be needlessly disturbed. The loops should be activated as already described, with a ligature wire passing through a staple on the end of the arch wire.

As soon as the desired space has been developed, the arch wire that has carried the loop is replaced by an ideal arch into which tip-back bends have been incorporated in the buccal segments and slight lingual crown torque in the anterior segment. The crowns of the teeth in the buccal segments are further tipped back until they are more vertical than is normal, *i.e.*, overtreated, while mild torque in the anterior segment is doing likewise to the teeth in this segment. To accomplish this movement without danger of appreciably displacing root apices forward the head gear should be used in conjunction with Class III intermaxillary elastics.

Anchorage preparation is now complete, and we have toe-hold all around to combat any tendency of these teeth to migrate forward as a result of obscure forces of occlusion or the wearing of intermaxillary elastics.

In cases in which the dental arches are very narrow, with for example, a lower lateral and central incisor partially blocked out lingually, the procedure is altered (Fig. 12) by banding only the blocked out incisors. An arch

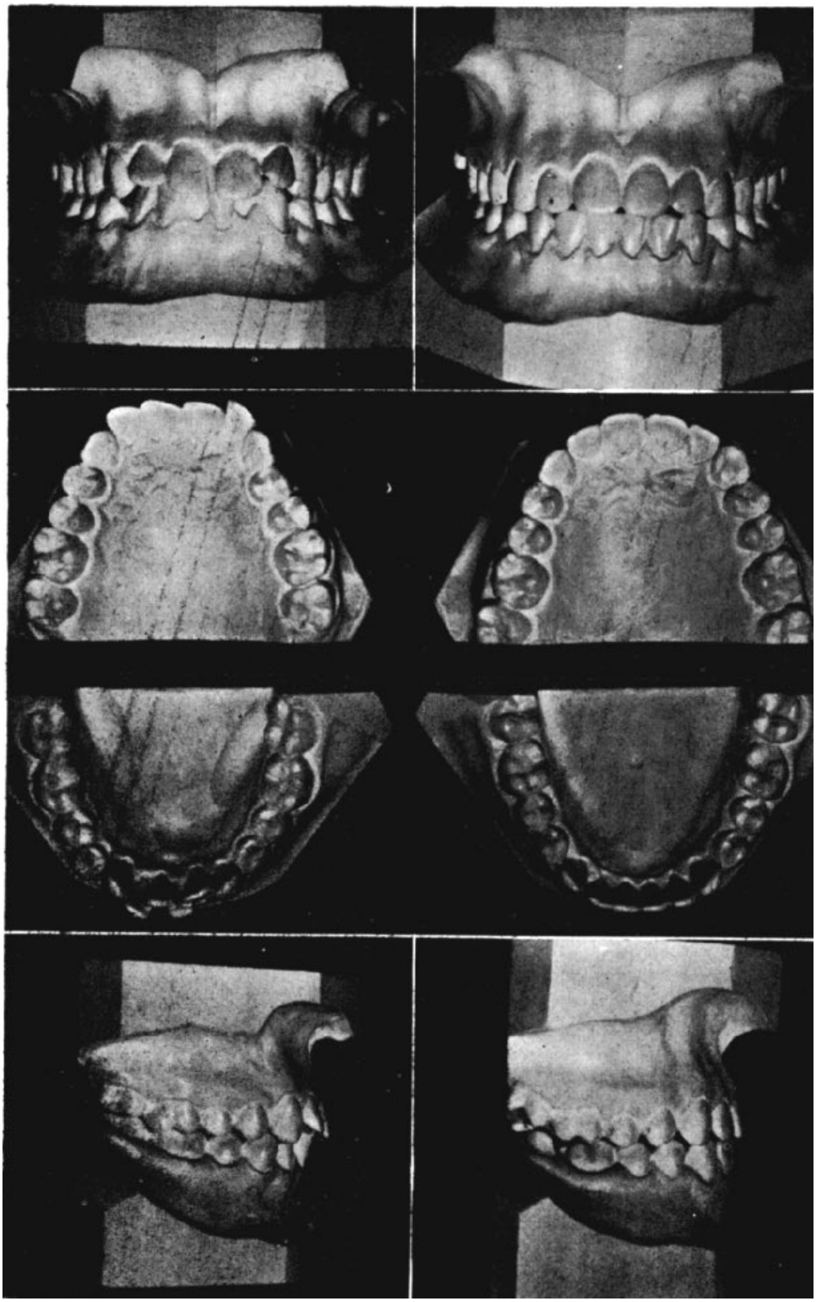


Fig. 12.—Class I malocclusion showing blocked out mandibular lateral and central incisors. Models at right show the treated cases.

wire of .021" square or .021" x .025" steel is fashioned, and two vertical Strang loops are incorporated into it. Loops are designed and placed midway between the central incisors and cuspids. Stops are soldered to the arch wire

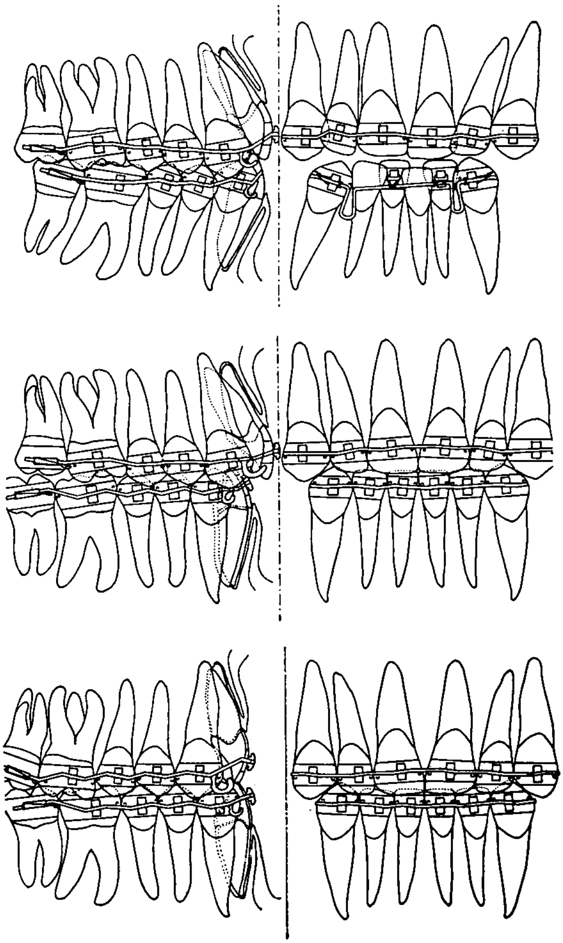


**Fig. 13.**—Mechanics used in treatment of case shown in Fig. 12.
A. Case as presented in Fig 12 with .020" round arch into which has been incorporated two vertical loops.
B. Showing anchorage preparation by distal *en masse* movement of the mandibular teeth with space made for the lateral and central incisors. Case at this stage resembles Class II malocclusion.
C. Utilization of Class II mechanics for distal *en masse* movement of the maxillary teeth, and artistic positioning of the incisors.

1 mm. distal to the predetermined position of the cuspid brackets. T's are soldered to the arch wire just mesial to the sheaths of the anchor teeth. The length of the arch wire from T to T is identical in length to that of an ideal arch with all the teeth in alignment. (Fig. 13A)

The arch wire is now tried in the mouth, and will be found considerably longer than the constricted dental arch under treatment. It is then removed and the loops constricted, while the wire is out of the mouth, with the ligature tying pliers and a suitable steel ligature. The constriction of both loops will shorten the arch wire from T to T to the extent of the amount that the loops are compressed. Thus the arch wire is brought into closer proximity to the brackets of the teeth in both buccal segments. Second order bends are made in the arch wire, which is then seated into as many brackets as conditions will allow, and the remaining teeth are tied snugly to it. Naturally, the incisal segment of the arch wire will belly out anteriorly.

Attachement of the banded inlocked incisors to the arch wire is made with a steel ligature, which is drawn up snugly until the compressed loops in the anterior arch segment are made to lie as close to the gum tissue as prudence will allow. There is a forward tension on the inlocked incisors which is increased when the ligature wires holding the vertical spring loops under compression are removed. The anterior arch segment is prevented from bellying forward by its attachment to the inlocked incisors. As a result, the action or force of the vertical spring loops under compression will be dissipated laterally, broadening the dental arch in the desired area. To prevent any forward arch wire migration through brackets or molar band sheaths, the wire is tied to the molar band sheath by passing a ligature wire around the sheaths and the T's soldered to the wire.

The head gear should be used in conjunction with Class III intermaxillary elastics attached to the loops to combat forward displacement of the mandibular teeth. At intervals of two weeks, without removing the arch wire, compress the loops again by means of a steel ligature applied with the ligature-tying pliers. The teeth in the buccal segments of the arch wire are now retied. With each adjustment the arch wire more nearly approaches the brackets of the teeth in the buccal segments, until finally bracket engagement is attained.

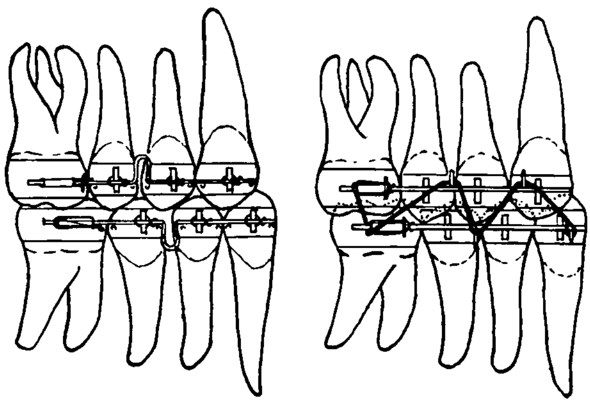
The inlocked incisors are moved into their proper positions as space for them is developed. The lower central and lateral incisor bands are cemented into place at this time, and the final adjustments are made by substituting an ideal arch wire for the arch carrying loops and by continuing the head gear and Class III mechanics as long as necessary.

The reason for not banding the right lateral and left lower central incisors at the beginning of treatment is to eliminate the possibility of tipping them into protrusive positions or of injuring the bone and investing soft tissues by uncontrolled and variable forces exerted in the anterior segment of the arch wire while the vertical spring loops are transmitting their pent-up forces.

Anchorage preparation is now complete.

In cases in which the teeth on one or both sides of the buccal segments of the maxillary arch have drifted forward, partially blocking out the cuspid teeth and causing them to erupt in such a position that we often call them high cuspid cases,I prefer not to band all the upper teeth in the usual manner. Instead, I prepare and establish proper anchorage in the mandibular arch by tipping the crowns of all the teeth in the buccal segments back to create toe-hold, using the head gear and Class III intermaxillary elastics if necessary, so there will be no undesirable forward movement of these teeth, in relation to the mandible, when intermaxillary force is applied to move the teeth in the buccal segments of the maxillary arch distally, in developing sufficient space for the accommodation of the blocked-out cuspids. The head gear can be attached to the mandibular arch wire, eliminating Class III intermaxillary elastic pull, if desired. Whenever possible, the mandibular second molars, not the first molars, carry the anchor bands. In the maxillary arch all teeth posterior to the cuspids are banded. The incisors and high cuspids are not banded at this time.

An upper ideal arch wire, .021" square or .021" x .025" steel, is made and tried in the mouth. If the positions of the cuspids are such as to make it necessary to deviate from the ideal arch form, the necessary deviations should be made in such a manner as to allow ample clearance of arch wire to cuspid and incisor teeth.



A B

**Fig. 14.**—A. Use of the vertical spring loop to close spaces between the teeth prior to retention. B. Use of up and down elastics to assist in seating the cusps of the teeth into their proper positions prior to retention.

Marks are made on the arch wire for stops, intermaxillary hooks, and second order bends. The arch wire is replaced and tested for accuracy after these attachments have been soldered on and second order bends have been incorporated. The stops should be so placed that the arch wire will stand at least 2 mm. away from the labial surfaces of the incisors and cuspid teeth. The arch wire is ligated to place. The patient is then instructed in the use of proper intermaxillary elastics and dismissed for two weeks. The head gear should be used at night to conserve anchorage in the mandibular arch. Whenever the arch wire closely approximates the incisor teeth, it is removed and lengthened by moving the stops back and altering the second order bends if necessary.

Class II mechanics are continued until the teeth in the maxillary buccal segments have been moved back sufficiently to develop the desired space or spaces necessary to accommodate the cuspid teeth. The incisors and cuspids are then banded and positioned along the arch wire in the customary manner.

Do not allow the arch wire to come in contact with the labial surfaces of the incisors in the maxillary arch during the time the teeth in the buccal segments of the arch are being moved distally. To do so is to tax needlessly the anchorage in the mandibular arch.

In finishing cases about to be retained, where there are spaces between the teeth, I know of no better method to close the spaces than to employ the principle of the vertical spring loop. When I close spaces in this manner I always make sure that the anchor molars are tipped back to afford maximum toe-hold. (Fig. 14A)

To seat the cusps of the teeth into their proper positions prior to retention, carefully made ideal arch wires into which normal curves of Spee have been fashioned are necessary. Attachments, such as are shown in Figure 14B, are soldered to these ideal arches, and the teeth are seated into their finished occlusal positions by means of vertical elastics. The removal of all bands between molar anchors and cuspid teeth will often allow these teeth to settle into position prior to retention. The case is then retained in the usual manner.

## CLASS II MALOCCLUSIONS

"When from any cause the lower first molars lock distally from normal with the upper first molars on their eruption to the extent of more than half the width of one cusp on each side it must necessarily follow that every succeeding permanent tooth to erupt must also occlude abnormally, all the lower teeth being forced into positions of distal occlusion, thereby causing more or less retrusion, or lack of development, or both, of the entire lower jaw."[10] (Fig. 15)

If for any reason there has been a drifting of these teeth, the extent of the drifting must be taken into consideration in diagnosis and treatment.

### Treatment

The plan of treatment from the beginning is to prepare the individual arches in the most efficient manner possible for distal *en masse* movement of the maxillary teeth, with minimum forward displacement of the mandibular teeth from the normal in relation to the body of the mandible.

The edgewise arch mechanism is potent. I like to think of it as two synchronized power plants, each possessing twelve or fourteen units or cylinders, not unlike twelve cylinders in the motor of a modern automobile. The efficiency of action of these twelve-unit power plants is dependent upon the co-ordinated action of all units within the mechanism. Especially is this true with the edgewise arch mechanism, when the object is the distal *en masse* movement of the maxillary or mandibular teeth.

What happens to our twelve-cylinder motor car when its engine is improperly timed?—which means that the ignition of the gases within the individual cylinders is not co-ordinated or synchronized? The consequence is that the forces applied to the pistons within the cylinders are working at odds, the whole car shakes and jiggles, and often there is not sufficient power generated to move it. When the timing has been corrected so that the forces transmitted to the individual power units—the pistons within the cylinders—are co-ordinated, the same car will glide forward without appreciable effort at a speed of 100 miles per hour.

As imperative as the correct timing of the modern automotive power plant is the co-ordinated action of the units composing the edgewise arch

[10] Angle, E. H. *Treatment of Malocclusions of the Teeth*, ed. 7, Philadelphia, S. S. White Dental Manufacturing Co., 1907, p. 44.

mechanism for the efficient *en masse* distal movement of teeth. Lacking such unified, co-ordinated action, the various individual units may actually work against one another. The teeth will jiggle in many directions, resulting in

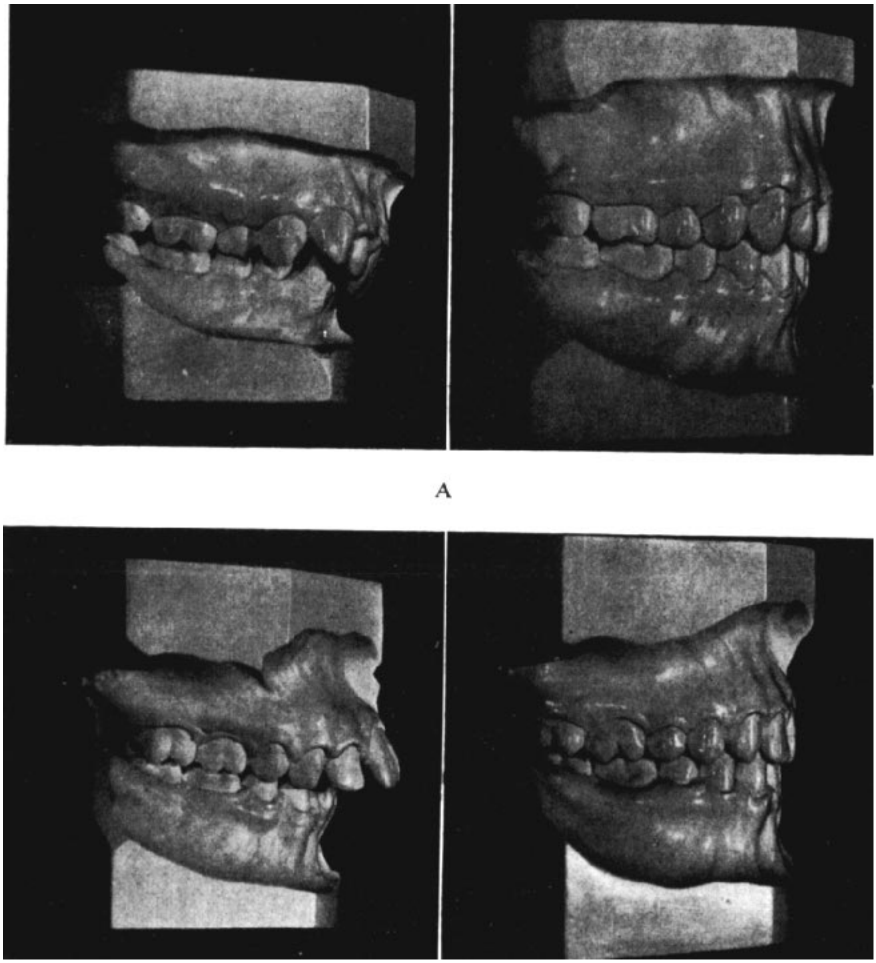


Fig. 15.—A. Class II, Division 2 malocclusion. B. Class II, Division 1 malocclusion. (Treated cases at right.)

considerable wear and tear on supporting tissues, and exacting a tremendous toll on mandibular anchorage. Because of these many conflicting forces within the mechanism there is often insufficient concerted power produced to effect true *en masse* distal movement of the teeth.

On the other hand, when the forces in the individual power units—in this case the second order tip-back bends in the buccal segments and the lingual crown torque in the incisal segment—are co-ordinated, it is possible to effect a distal *en masse* movement of the teeth.

## Plan of Treatment

The treatment should be divided into three stages, *viz.:*

1. The preparation of a more stable form of stationary anchorage in the lower arch, and the elimination of toe-hold or stationary anchorage in the upper arch.
2. Distal *en masse* movement of the maxillary teeth, along with development of the body of the mandible, without forward displacement of the mandibular teeth.
3. Detailed positioning and arch form prior to retention.

## The Lower Arch—Anchorage Preparation

The co-ordinated action of each unit in the mandibular arch will result in the greatest anchorage that can be developed intraorally. Such a co-ordinated action is exactly what we try to achieve in preparing anchorage in the mandibular arch.

Fortunately, the lower arch in Class II cases is usually characterized by teeth that are more or less regular in alignment and in fair relationship to the body of the mandible, so all the bracket bands are cemented to the teeth, with the exception of those immediately anterior to the molar anchor teeth. In some cases this will be the first permanent molars; in others, the second bicuspids.

After an .016″ round steel arch is inserted, with bends to begin uprighting the anchor teeth, the case is dismissed for from ten to fourteen days, or until the patient has recovered from the discomfort occasioned by initial tooth movements, which are usually painful.

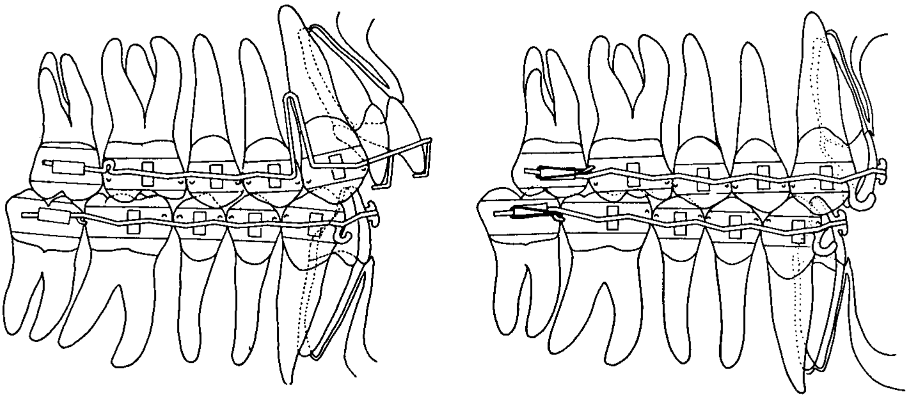
At the second visit an .018″ or .020″ round arch is inserted and continued until loss of contacts, if present, is reduced, but the arch is so fashioned that small loop stops are made one-eighth inch anterior to the buccal sheaths. The arch is then tied securely to the buccal sheaths with a steel ligature. The case is then dismissed for two weeks. In most cases the contacts are closed within four weeks.

We are now ready for the next step. With a resilient .021″ x .025″ steel arch wire, augmented with Class III intermaxillary pull, we tip or move the mandibular teeth back and develop toe-hold to resist forward displacement of these teeth when Class II intermaxillary elastics are used later. The arch wire must always be securely tied with strong steel ligatures to the anchor teeth by means of utilizing a T spur or hook placed just anterior to the buccal sheath. The movement is accomplished by co-ordinating the action of the second order bends in the buccal segments with one another and with lingual crown torque force in the incisal segment. Thus all units work in unison to accomplish the movement. (Fig. 16B)

While a molar can be uprighted through the anchorage available in the teeth of the buccal segments, it must be remembered that it is impossible to upright all the teeth in the buccal segments with second order bends without forward displacement of their root apices, unless a proper intermaxillary force is employed. Hence, Class III intermaxillary elastics and the head gear must be used when the .021″ x .025″ resilient arch is placed and the case is ready for distal *en masse* tipping.

When the molar anchor teeth show signs of being tipped back slightly and the incisor tooth crowns of being torqued lingually, the tie bracket bands immediately anterior to the anchor teeth are cemented into place. Distal *en masse* movement of the mandibular teeth is continued and the degree of all co-ordinated bends is increased slightly every two or three weeks. The head gear and Class III intermaxillary pull are continued until anchorage is complete and toe-hold has been developed to resist any forward tipping when Class II intermaxillary pull is employed.

When anchorage is complete, which means that the mandibular teeth are positioned correctly to the mandibular base and toe-hold has been obtained through tipping the anchor molars upward and backward, the .021" x



A B

**Fig. 16.**—A. .020" round arch wire with incisal spurs to reduce excessive axial inclination of incisors and break down toe hold. B. Anchorage preparation completed in the mandibular arch, and excessive axial inclination of maxillary incisors corrected. Bands have been placed on the maxillary incisors prior to instituting distal *en masse* movement of all the maxillary teeth.

.025" arch wire is replaced by .021" x .028" stabilizing arch wire. Into this wire are incorporated second order bends and incisal torque identical to the amount incorporated into the .021" x .025" arch wire used during anchorage preparation.

In approximately four months from the time the first round steel arch wire is placed, anchorage preparation should be complete. Normal relation of the mandibular teeth to the base bone is attained and the axial inclination of all the teeth altered for mechanical advantage without undue mesial displacement of the root apices. Thus the maximum resistance to forward displacement during the use of Class II intermaxillary force will be secured.

## The Upper Arch

In the upper arch the procedure is the same as in the lower, except that in very pronounced protrusions of the incisors, bands are not cemented in place on these teeth at this time. In my opinion it is a mistake in extreme protrusion cases to band all the teeth, insert square ideal arches with bracket engagement and start the wearing of intermaxillary elastics from the beginning of treatment. Unless satisfactory preparatory work is accomplished and anchorage intelligently diagnosed, the result is very likely to effect double protrusion by the anterior displacement of the mandibular teeth instead of the distal movement of the maxillary teeth.

All spaces are closed in the maxillary arch, and the excessively abnormal axial inclinations of the protruding incisors are reduced by means of an .021″ round arch wire into which vertical Strang loops have been incorporated between the cuspids and first bicuspid teeth. The molar anchors are tipped back enough to resist displacement forward when the loops are activated or opened. The head gear should be used to lighten the load and prevent forward displacement of the anchor molars. Four long spurs soldered to the incisal segment of the arch wire and bent lingually over the incisal edges of

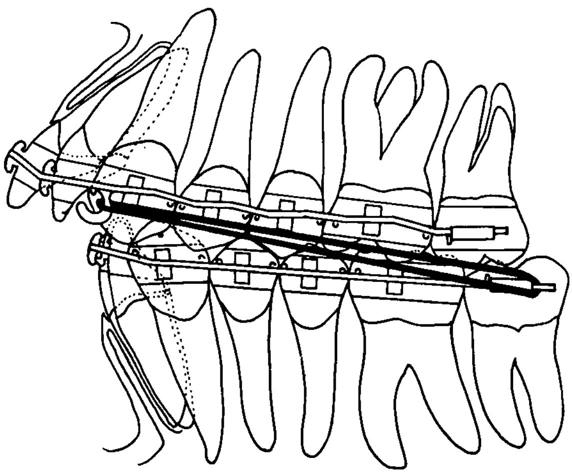


**Fig. 17.**—Square arch used where maxillary incisors are protruding, and illustrating how these incisors must be moved bodily in their malposed positions, if moved at all.

the central and lateral incisors are used to prevent the arch wire from creeping gingivally and elongating these teeth. Distal pressure on the labio-incisal angles of these teeth tips the crowns lingually without displacing the root apices labially. (Fig. 16A)

When incisal spurs are soldered to a round arch wire to accomplish this action, a minimum amount of anchorage is required in the maxillary buccal segments. When a square arch wire is used in such cases, with the incisors carrying bracket bands, the abnormal axial inclination of the maxillary incisors provides unfavorable stationary anchorage and resists distal or lingual movement of the teeth. (Fig. 17) A round arch wire with incisal spurs is necessary to correct the axial inclinations and thus break down toe-hold or stationary anchorage in the incisal segment and to reduce resistance to the *en masse* distal movement of the maxillary incisor teeth.

When the excessive protrusive condition of the incisors is corrected, these teeth are banded and a heavy stabilizing arch wire of .021″ x .028″ is made to replace the round arch wire previously carrying the loops and incisal spurs. Into this heavy arch wire are incorporated slight molar kick-back bends, slight second order bends in the buccal segments, and slight lingual crown torque in the incisal segment. (Fig. 16B)

These bends should be of just sufficient degree to resist forward tipping displacement of the maxillary teeth when Class III intermaxillary pull is instituted to tip or move the mandibular teeth distally to prepare anchorage in the mandibular arch. During the daytime light Class III elastics are used, but at night, when the head gear is worn, heavier Class III elastics are used. As usual in both arches, the arch wire is tied to the molar band sheath to bind the whole dental arch into a unit.

The head gear worn at night, attached to the maxillary arch wire, helps to prevent mesial displacement of the maxillary teeth during the time Class III intermaxillary pull is in effect. This head gear exerts a distal pull on the maxillary teeth about twice as great as the mesial pull on this arch occasioned by the Class III intermaxillary elastics.

Perhaps this is the place to digress in order to give a more detailed explanation of why protruding incisors should not be banded at the beginning of treatment. Most of us agree that the root apices of individual teeth usually have been less disturbed or moved from their normal positions than any other part of the particular anatomy of the involved tooth or teeth; that is, the apices are nearest their normal positions.

When these teeth have been banded and bracket engagement obtained with a square arch wire inserted passively, or devoid of torque force, they are locked in stationary anchorage just as soon as the clearance or slack between the bracket and arch wire has been dissipated. (Fig. 17) From this instant these teeth, if moved distally, must be carried back bodily through bone in their malposed axial positions.

Surely one can visualize what is certain to happen. The mandibular teeth, unless anchorage has been properly prepared, tip forward or slide along through the alveolar process into protrusion, with little or no development of the body of the mandible. The end result is a Class I cuspal relationship and a Class II jaw relationship. (Fig. 18)

Some operators say they torque the incisor crowns lingually and the roots labially in the maxillae to prevent drag. But if this is done none of us can say that we are not displacing root apices forward, which is certainly undesirable. Nor do I believe that we can work so accurately that we can determine when torque force is spent. Does the torque last three days or three months? I, for one, do not know. However, this much seems certain: when torque force is spent, the incisor teeth attached to the arch wire are no longer being tipped, and they begin to drag or create toe-hold or stationary anchorage against distal *en masse* movement of the maxillary teeth, thus straining anchorage in the mandibular arch. During this procedure of torquing the incisor roots out and their crowns in or back, and finally, the root apices back again, the whole tooth has been going "round and round," as it were, which is not physiologic tooth movement,[11] and not infrequently is conducive to root resorption.

It would, of course, be more logical to use an .021″ round arch wire than a square wire if the protruding incisors were to carry bracket bands at the beginning of treatment. The long axes of these teeth are not always parallel

[11] The term "physiologic tooth movement" is here used in a comparative sense. Actually there is probably no such thing as physiologic tooth movement with regulating appliances.

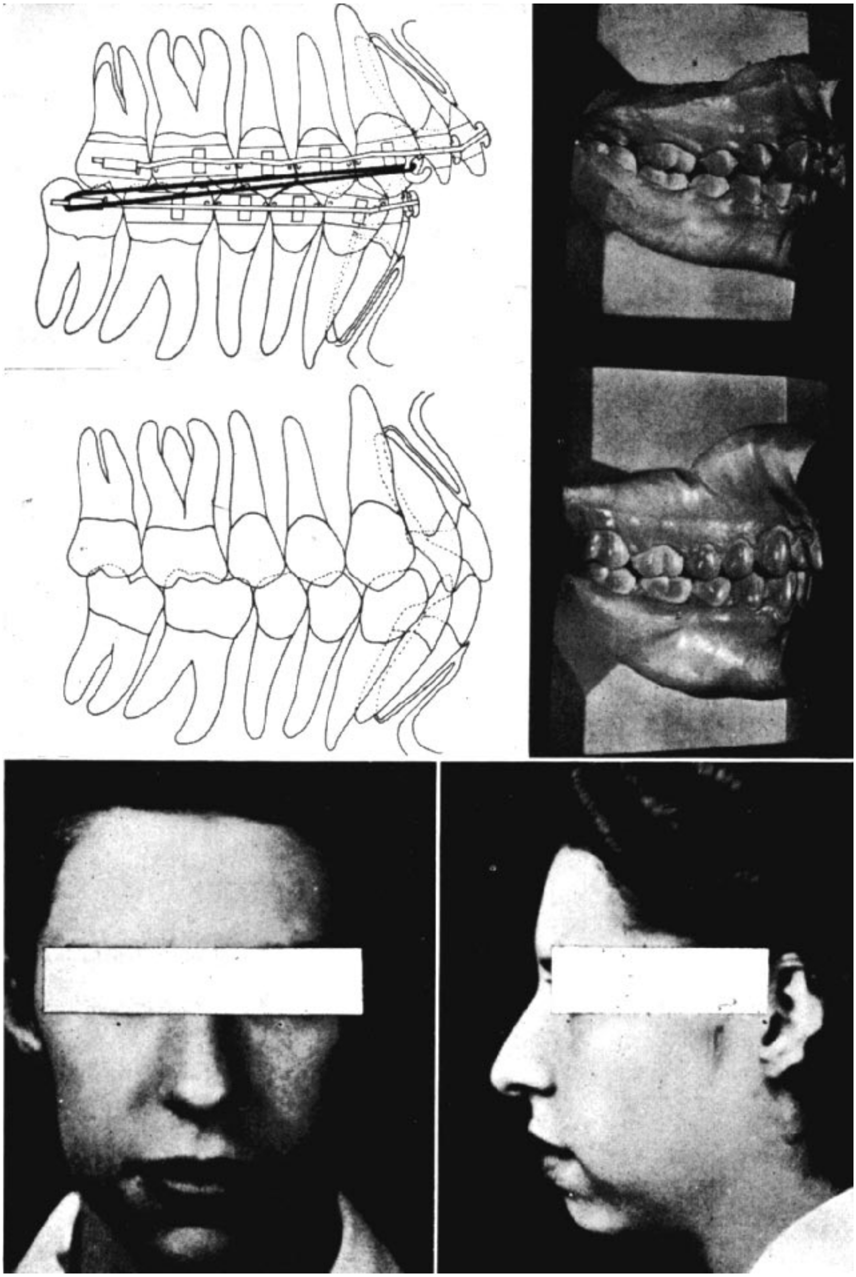


**Fig. 18.**—Class II. Division 1 malocclusion treated by banding all the upper incisors instead of leaving them unbanded during the first stages of treatment to reduce their axial inclination. The end result shown in the lower model is a Class I tooth relationship and a Class II jaw. This is a case of bimaxillary protrusion caused by improper orthodontic treatment. Note the face is still in protrusion.

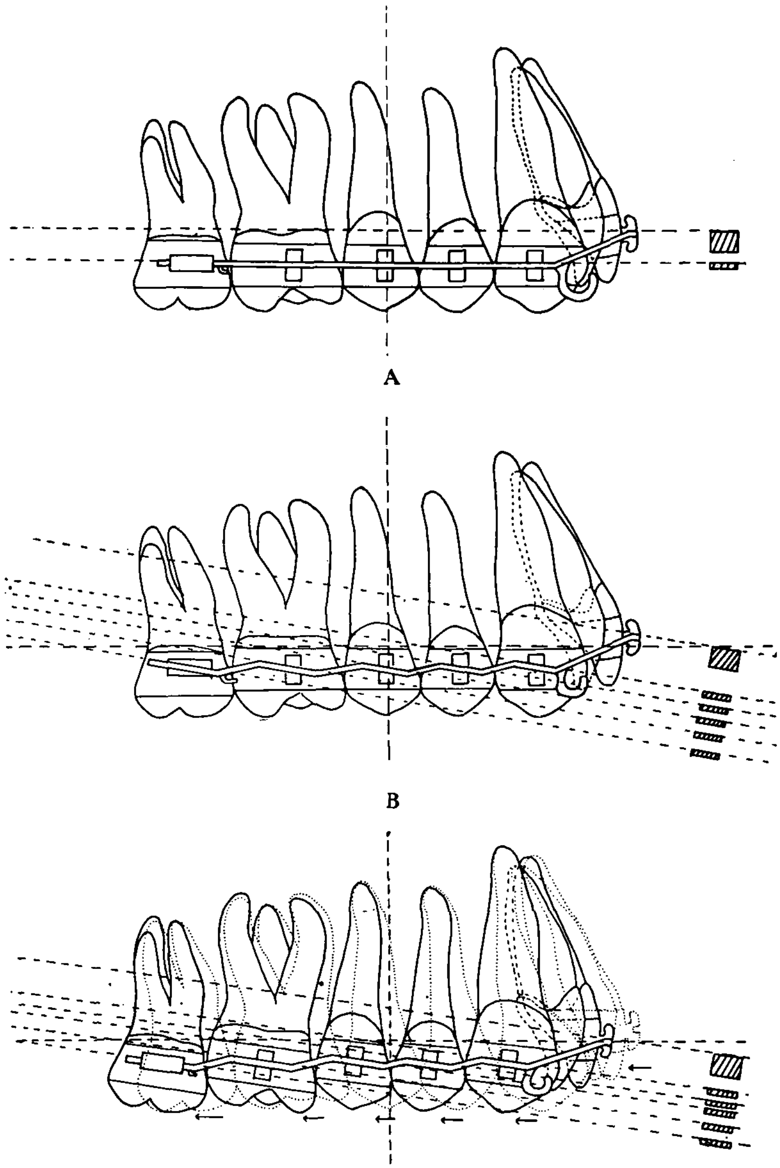



**Fig. 19.**—A. Arch wire in passive state. B. Correct co-ordinated second order bends with incisal torque. C. Illustrates action when intermaxillary force is applied to co-ordinated bends.

to the median line, nor is the arch form in this region a straight line. Therefore, even with a round arch wire some drag will be occasioned by the very positions of these teeth and anchorage in the mandible, of which there is never too much, will be taxed. So it seems reasonable to me that anchorage is best conserved in the mandibular arch when the upper incisors are not banded until they have been tipped into approximately their correct axial positions by drag caused by the distal movement of the maxillary buccal segments, with second order bends, proper intermaxillary elastics, and head gear used when indicated.

### *En Masse* Distal Movement of the Maxillary Teeth

Having completed my discussion of anchorage preparation in the mandibular arch and the breaking down and lessening of unfavorable stationary anchorage or resistance to *en masse* distal movements in the maxillary arch, I shall now go on to the detailed techniques of *en masse* distal movement of the maxillary teeth.

A resilient ideal arch wire of .021″ x .021″, or .021″ x .025″ steel, is carefully fashioned. A curve of Spee is incorporated into the arch wire, which is seated into the brackets of all the teeth, ligated into place, and worn for two weeks. (Fig. 19A)

At the next visit the arch wire is removed and cleaned and then replaced in the mouth and reseated into the brackets. At this time it should be more or less passive in all bracket engagements. With a small file, marks are made on the arch wire immediately in front of both molar band sheaths. Similar marks are made 1 mm. mesial to and 1 mm. distal to the bracket margin of each bracket in the buccal segments, including the cuspid bracket. The arch wire is then removed and mild second order bends are incorporated into the buccal segments from the region of the second molar to and including the cuspid. These second order bends must be identical in degree. We start from passive, and if our second order bends are identical in degree we shall have co-ordinated forces and, as a consequence, co-ordinated *en masse* movements. Mass lingual crown torque is incorporated into the incisal segment of the arch wire. The torque in the incisal segment must be identical in degree to the second order bends in the buccal segments of the arch wire if our *en msse* distal movements are to be co-ordinated or synchronized. Incisal torque force must be considered as only an additional second order bend incorporated into a cross-section of the arch wire. (Fig. 19B) Brass intermaxillary hooks and tie-back T's or spurs are soldered to the arch wire, which is then replaced in the mouth and ligated into place. Torquing and arch-seating irons are necessary in order to seat the arch wire with the least discomfort to the patient.

The patient is instructed to wear mild Class II intermaxillary elastics. For the first three days intermaxillary force causes some discomfort. After that time there is no discomfort if the patient wears the elastics constantly, which must be done to attain the maximum of maxillary distal crown tip and the minimum of mesial displacement of the maxillary root apices. It is essential to impress both patient and parent with the necessity of wearing the elastics constantly.

After two weeks the upper arch wire is again removed and the degree of the second order bends and incisal torque is accentuated. All the second order bends and the incisal torque should be accentuated to the same degree so that all power units in the arch wire will work together in co-ordinated *en masse* distal movement. Stronger intermaxillary pull is applied at this time. (Fig. 19C)

At the next appointment the lower anchorage units are checked. If the lower anchor molars show the slightest signs of mobility, the mandibular arch wire is removed, the anchor molar kick-back bends are increased slightly, and all second order bends in the buccal segments are increased in identical amount. The mass lingual crown torque in the incisal segment is increased until it corresponds in degree to the second order bends. Slight additional lingual crown torque is placed in the distal segments of the arch to torque the crowns of the anchor molars lingually and their roots buccally. The second order bends must be kept equal in degree, and equal also to the degree of lingual crown torque in the incisal segment. It should be kept in mind that co-ordinating every unit in the mandibular arch to resist forward displacement develops the greatest possible amount of intraoral anchorage.

At intervals of two to three weeks the degree of the bends in the maxillary arch wire is increased, always in co-ordination, until normal mesio-distal re-

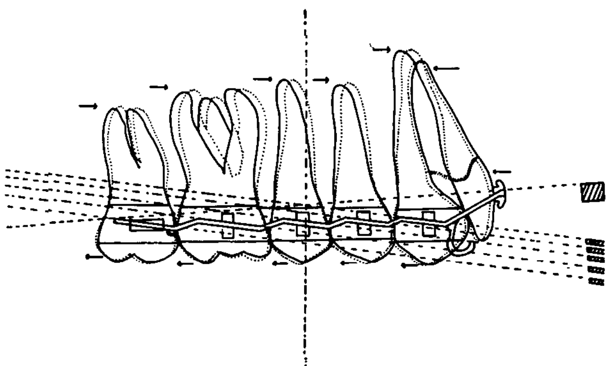


**Fig. 20.**—Non-co-ordinated second order bends and anterior lingual crown torque. Result is too much mesial movement of root apices, with incisor segment acting as a drag.

lationships of the teeth are attained. This treatment is continued until the incisors present an edge-to-edge relationship. The intermaxillary elastics are then discontinued for two weeks to make certain that there has been sufficient *en masse* distal movement of the maxillary teeth. If there has not, treatment is continued as formerly. If the movement is considered complete, apply the elastics again until an edge-to-edge incisal relationship results. The case is then retained.

Why is such co-ordination between second order bends and incisal torque necessary? As I see it, our object is to gain and maintain not only correct mesio-distal and bucco-lingual relations between the teeth of opposing arches, but also correct relations of the teeth to their respective bony bases. If our mechanics are not timed minutely and co-ordinated correctly, the individual units within the dental arches will oppose one another rather than move together as a unit. For instance, if the second order bends in the buccal segments of the arch wire are of greater degree than the lingual crown torque in the incisal segment, the incisors act as a brake to the distal tip-back force exerted on the buccal teeth. As a consequence, the second order bends, instead of tipping or moving the crowns of the buccal teeth distally, tend to move their root apices mesially. (Fig. 20) Obviously the result will be a malrelation of the teeth to their bony bases. Our efforts in treatment, therefore, have not been basic. We have only substituted one malocclusion for another, and the one we produced may leave the patient in worse condition than the one we were attempting to correct.

On the other hand, if the force developed by the lingual crown torque in the incisal segment is greater than the force of the second order bends in the buccal segments, the roots of the incisors are displaced labially into protrusion because of lack of speed in the distal movement of the teeth in the buccal segments. It is imperative, therefore, that all forces occasioned by second order bends and incisal torque be timed and co-ordinated so that all units taking part in the *en masse* movements will be moved distally at the same rate of speed.

The greatest teacher of orthodontics who ever lived taught me that good mechanics go hand in hand with good biology. Dr. Angle once said: "Orthodontia is born at the chair. There it is that you recite your lessons that will tell the world what you know of your profession." He felt that there was nothing menial about possessing a keen knowledge of mechanics as applied to biology in the practice or orthodontics. The point could be remembered with profit by dentists and surgeons, as well as by orthodontists.

## Correction of Anterior Overbite

If the depression of the lower incisors and elevation of the lower molars have a tendency to open the bite, vertical elastic rubbers are used in the region of the cuspids, in addition to a slow Class II rubber. This up and down intermaxillary force counteracts depression, and in so doing increases the efficiency of second order bends in tipping the teeth back. The intermaxillary elastic should not create too much pull; it should be slow but constant, in order not to strain anchorage in the mandibular arch and to secure the maximum mandibular development with minimum anterior displacement of the lower teeth.

When a normal mesio-distal arch relationship has been established and checked to make certain of its permanency, some degree of the second order bends can be removed from the arch wire, and such alterations of the axial inclinations of the moved teeth may be made as are deemed necessary. As a general rule I do not remove the second order bends before retention. When I do, the head gear and Class III mechanics are in order. Occasionally after the establishment of a normal mesio-distal arch relationship and correct cuspal relations, an examination of the front and profile views of the patient will disclose a lack of vertical development or a bite that is closed even though the incisors are edge to edge. Certainly our treatment is not completed if this condition is present. (Fig. 21)

In such a case an accurate modeling compound impression is taken of the palatine surface of the mouth with the bands and arch wires in place. A bite plate is made in such a manner that only the upper and lower incisors, both centrals and laterals, engage the plate and hold the opposing buccal segments of teeth approximately one-eighth inch apart.

Both arch wires are cut between the cuspids and lateral incisors. The ends of the segments in the maxillary arch are turned up and disked smooth. The lower arch wire segments are turned down and smoothed. (Fig. 22A) A large intermaxillary elastic is engaged around the distal ends of the pos-

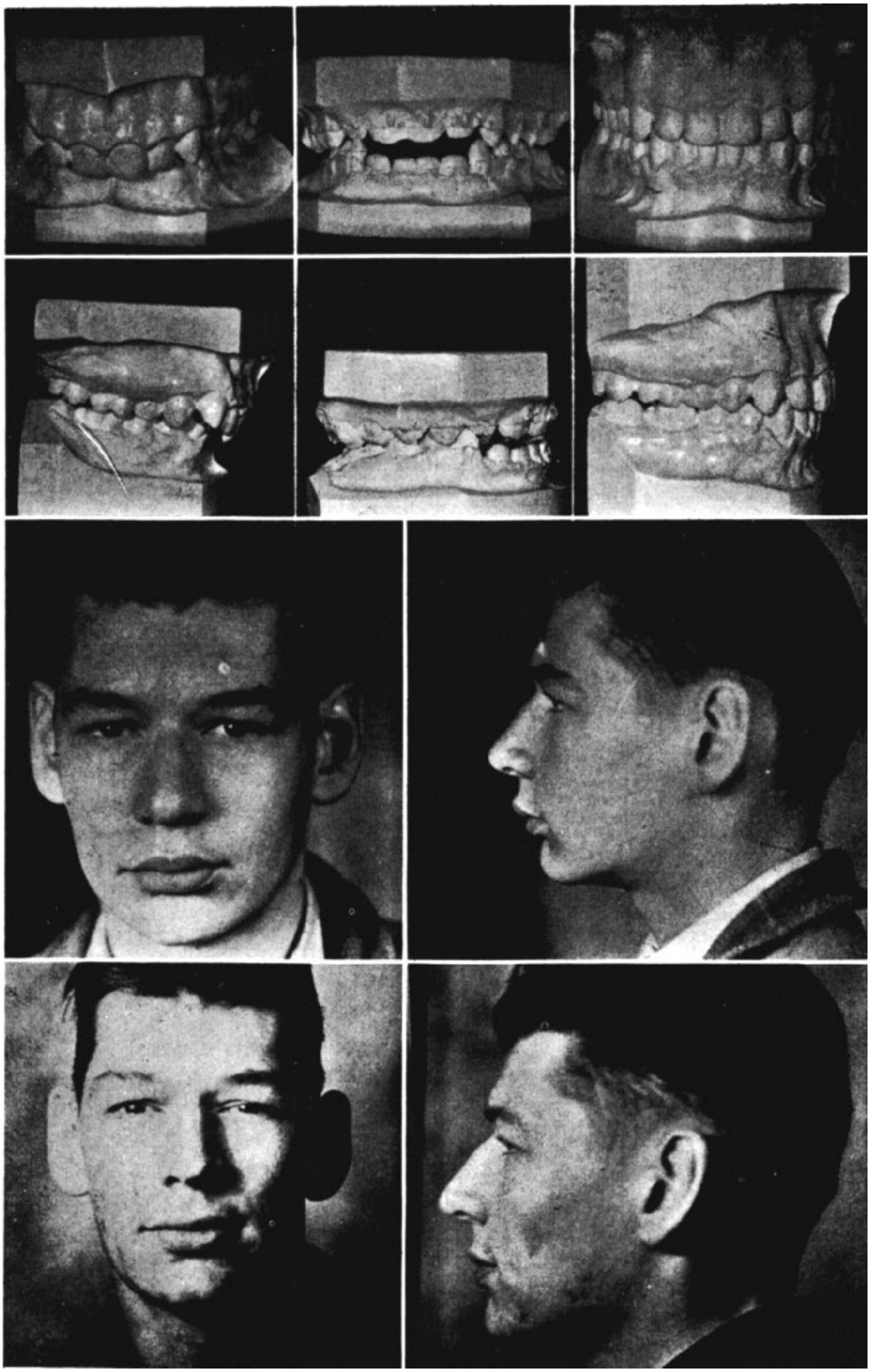
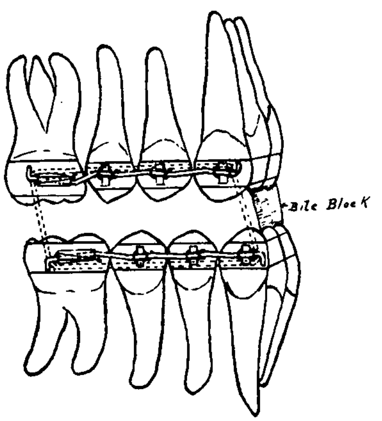


**Fig. 21.**—Models show steps in treatment of deep anterior overbite after normal arch relation has been achieved. Upper face photographs show lack of vertical development, and lower ones the face after anterior overbite is corrected.

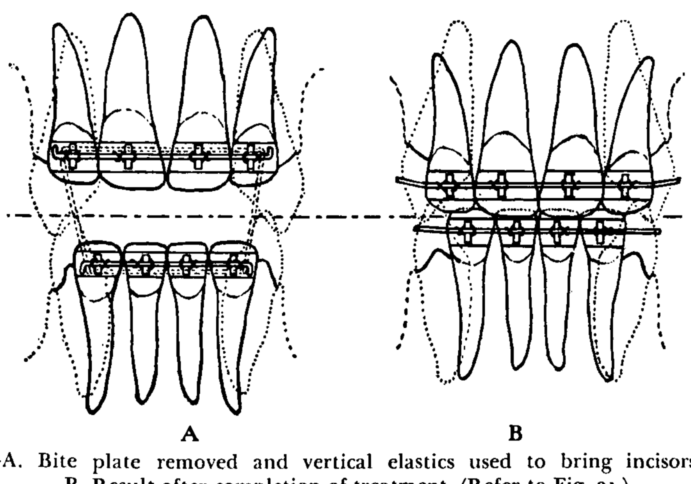



A B

Fig. 22.—A. Application of oblong vertical elastics in closing buccal space. B. End result after elastics have been used. Note that the incisors are still kept apart by pite plate.

terior arch wire segments, which have been turned up in the maxillary arch behind the molars, and down in the mandibular arch. The elastic is brought forward and hooked around the mesial ends of the lateral arch segments both above and below, to form an oblong figure with vertical pull in the molar and cuspid region of the buccal segments of each dental arch. With the bite plate in place, the buccal segments on each side are drawn together at the rate of one-eighth inch every two months. If more vertical development is necessary, the bite plate is altered to open the bite further, and the process is continued.

When the operator judges the desired amount of vertical development to be accomplished and the teeth in the buccal segment are in good occlusion, the wearing of the bite plate is continued for from three to four months without the intermaxillary elastics to allow osseous development to take place



A B

Fig. 23.—A. Bite plate removed and vertical elastics used to bring incisors together. B. Result after completion of treatment. (Refer to Fig. 21.)

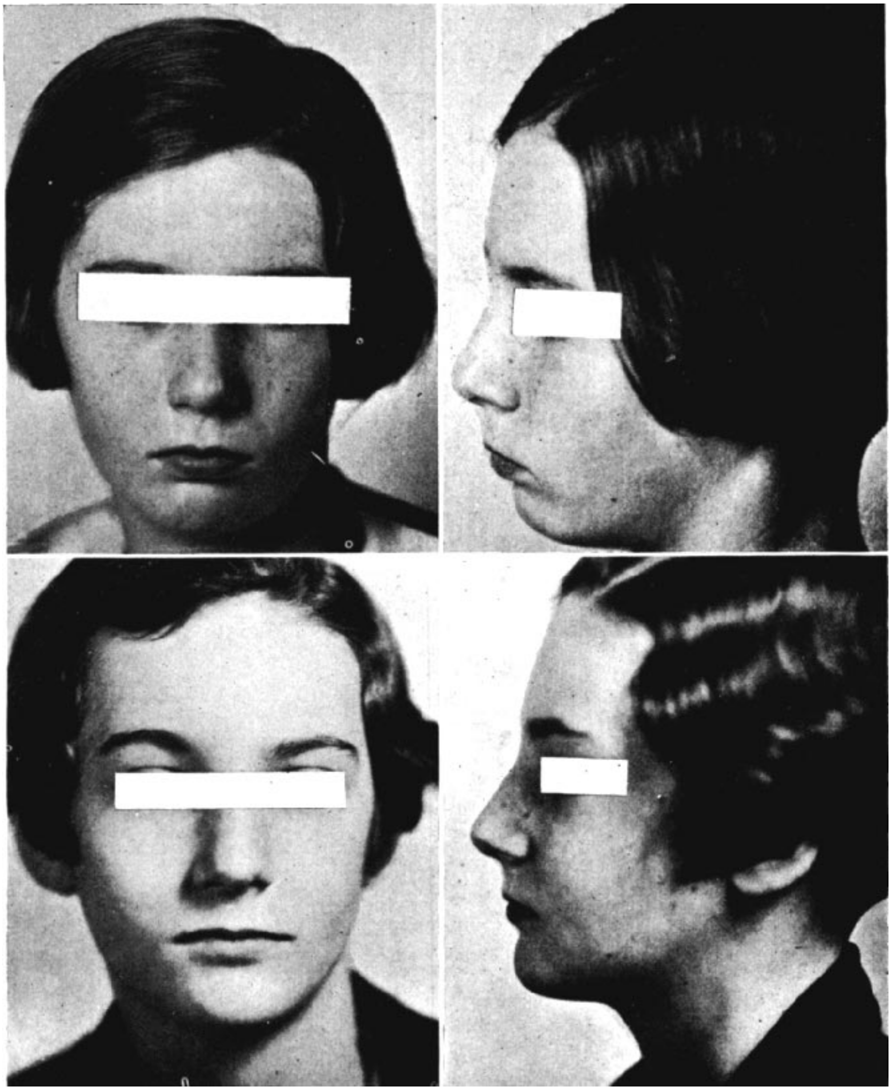


**Fig. 24.**—Result of Class II treatment showing balance and harmony of facial features when mandibular teeth are placed or maintained in a normal relation to their bony bases.

around the roots of the teeth in the buccal segments. The bite plate is then removed and the space between the incisal edges of the teeth forming the upper and lower incisor segments will be found to be from one-eighth to one-fourth inch, depending upon the amount of vertical development achieved in the buccal segments. (Fig. 23A)

A large elastic is now passed around the ends of both upper and lower anterior sectional arch wires that extend from the distal of the lateral incisors to form a square figure with vertical pull. This elastic is worn until the

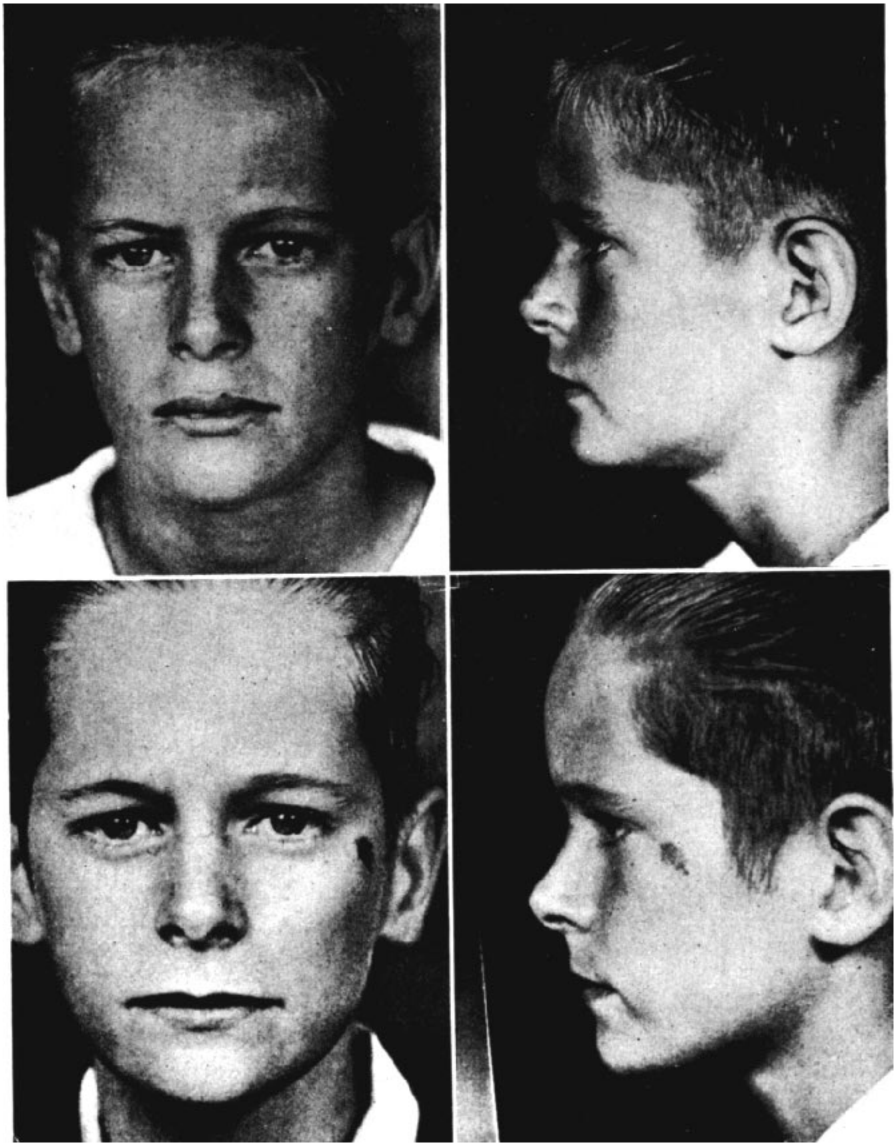


**Fig. 25.**—Result of Class II treatment showing balance and harmony of facial features when mandibular teeth are placed or maintained in a normal relation to their bony bases.

anterior segments are brought to their proper relation with each other. (Fig. 23B) The segments of arch wires above and below are then replaced by carefully formed ideal arch wires and the final adjustments are made prior to retention. The case is retained in the customary manner.

We have often heard orthodontists remark, "Some of my beginning

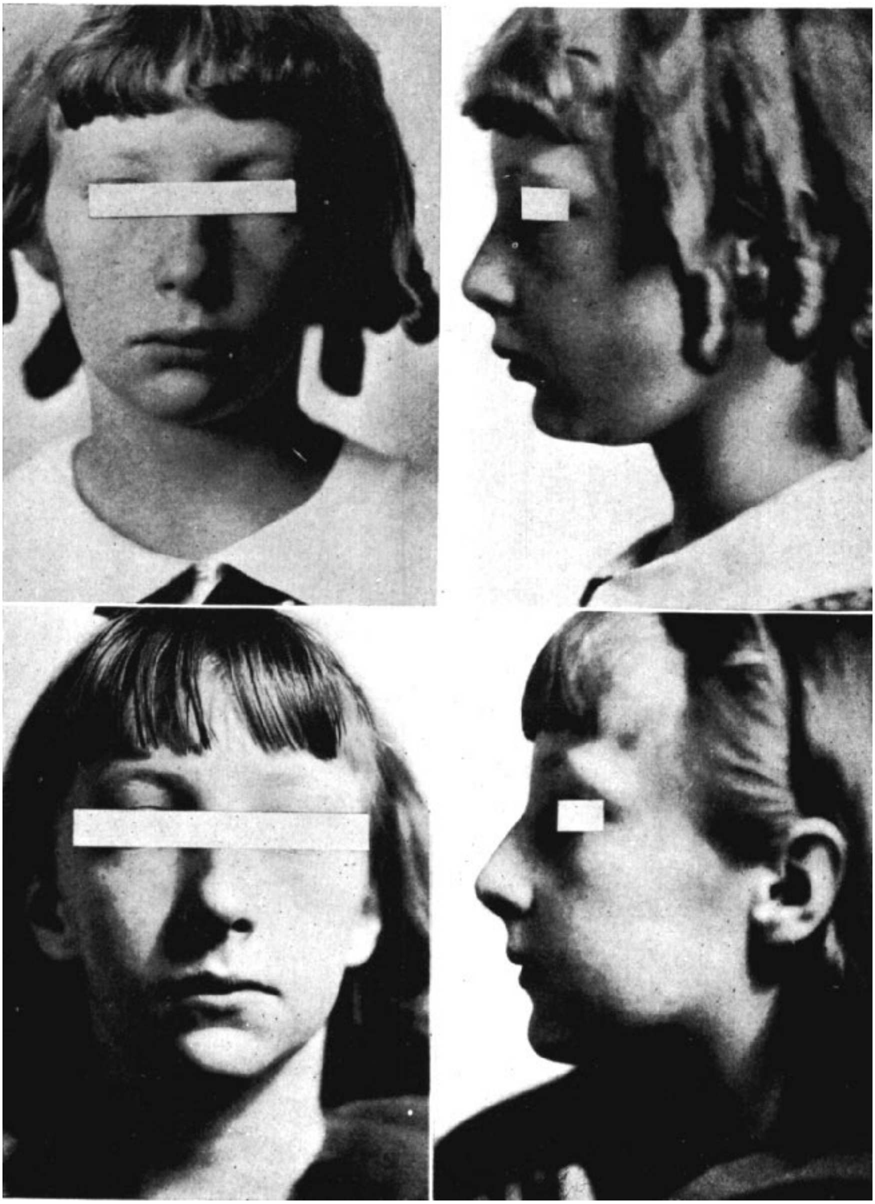


**Fig. 26.**—Result of Class II treatment showing balance and harmony of facial features when mandibular teeth are placed or maintained in a normal relation to their bony bases.

photographs look better than the pictures of my treated Class II cases, and sometimes years are required for them to get chin development." We all have too many cases like that. As a rule, my earlier cases never seemed to develop much chin. Now, however, I think I know why.

At the beginning of my career as an orthodontist I had the mistaken idea that if every tooth was carefully banded, ideal arch wires with second

**Fig. 27.**—Result of Class II treatment showing balance and harmony of facial features when mandibular teeth are placed or maintained in a normal relation to their bony bases.

order bends inserted in the maxillary arch wire, intermaxillary elastics applied, irregularities corrected, and Class I cuspal relationships gained, then this little mechanism would in addition do all the thinking for me. How I was fooled! Every so often it would rebel and fail to act as it had done in similar cases under apparently identical conditions. I would worry along

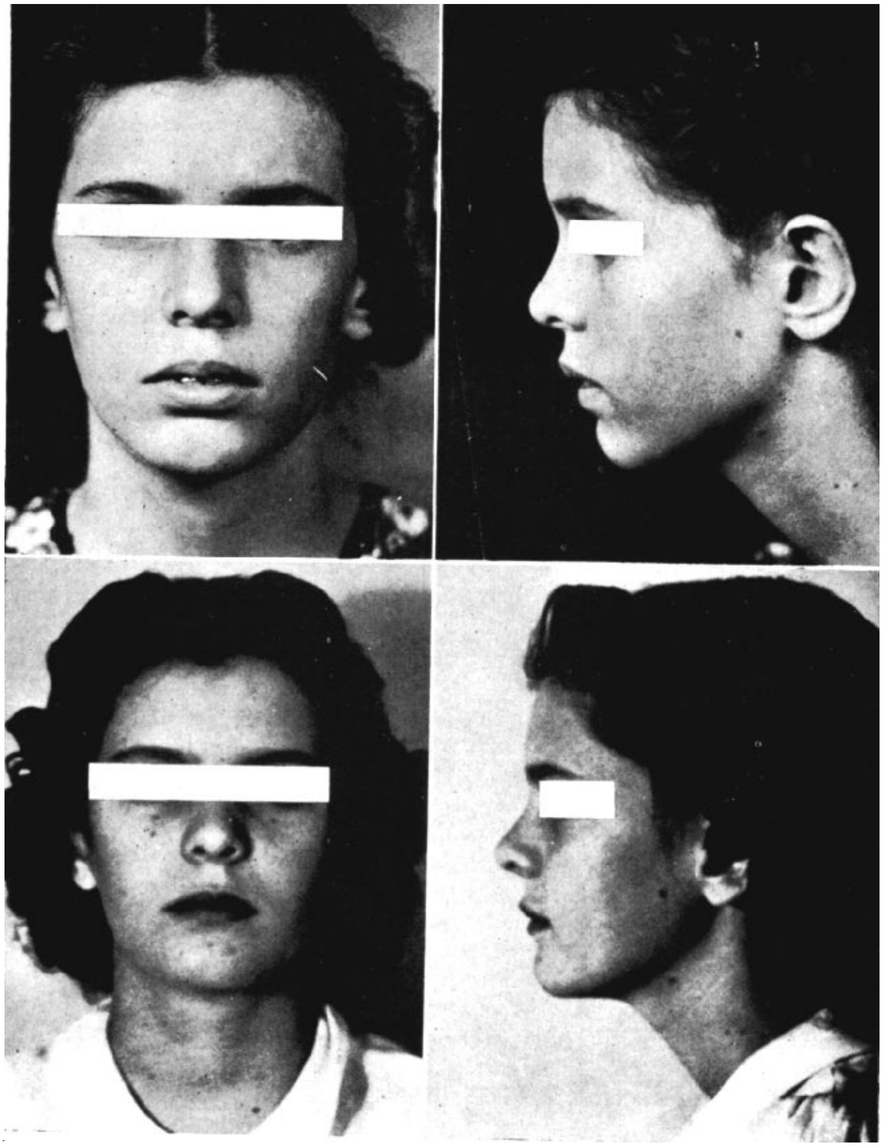


**Fig. 28.**—Result of Class II treatment showing balance and harmony of facial features when mandibular teeth are placed or maintained in a normal relation to their bony bases.

and finally wind up with an underdeveloped mandible and a horsey looking set of teeth—an orthodontically created bimaxillary protrusion, of which we all produce too many.

Why? Because I did not diagnose, study, plan, and utilize properly the various energies within this mechanism. The mandibular and not the maxillary teeth were the ones that did the moving.

The picture is clearer now, somewhat late for my peace of mind, but I will no longer abuse this efficient mechanism by trying to use it as a modified E arch. The results of Class II treatment showing balance and harmony of facial outline when the mandibular teeth are placed and maintained in a normal relation to their bony bases are illustrated in Figs. 24-25-26-27-28.

## CLASS III MALOCCLUSIONS

When from any cause the lower first molars lock mesially from normal with the upper first molars on their eruption, to the extent of more than one-half the width of one cusp on each side, it must necessarily follow that every succeeding permanent tooth to erupt must also occlude abnormally, all the lower teeth being forced to positions of mesial occlusion, thereby causing more or less protrusion, or over-development, or both, of the entire lower jaw. (Fig. 29) If for any reason there has been a drifting of these molar teeth, the extent of the drifting must be taken into consideration in diagnosis and treatment.

### Plan of Treatment

The plan of treatment and mechanics here described apply to cases of true Class III types of malocclusion, and not to those which, because of mechanical inlocking of the upper incisal segment behind the lower, give the appearance of Class III malocclusion, when in reality they belong to the Class I type. Such cases should be treated with the mechanics described under Class I treatment. The necessity of maintaining the teeth in a normal relationship to their respective jawbones and, at the same time, placing the teeth in each arch in normal cuspal relationship with their antagonists in the opposite arch should be borne in mind.

The mechanics of treating Class III malocclusions present no unusual problems to the orthodontist, but the problem of maintaining the relations gained in active treatment through the retention period is really troublesome. Class III cases should be treated as soon as the abnormality is discernible, which at times is as early as the second year. At this early age a chin strap is often all that is necessary to effect normal jaw and cusp relationships.

When the abnormal relationships have been operative over many years before I see the case, as often happens, I have no doubt about the seriousness of the situation. If the patient is within the age range of ten to fifteen years and will follow instructions after active treatment has been completed, I have good success in permanence of result. I find it necessary to have the patient wear a chin strap at night during the entire period of growth and development following active treatment. The distal pressure exerted by the chin strap on the mandible at night seems to retard the abnormal growth process, even though the X-rays show an enlarged and probably overactive pituitary.

In Class III malocclusions the body of the mandible is overly large and the mechanics of occlusion are such that by their very nature the upper

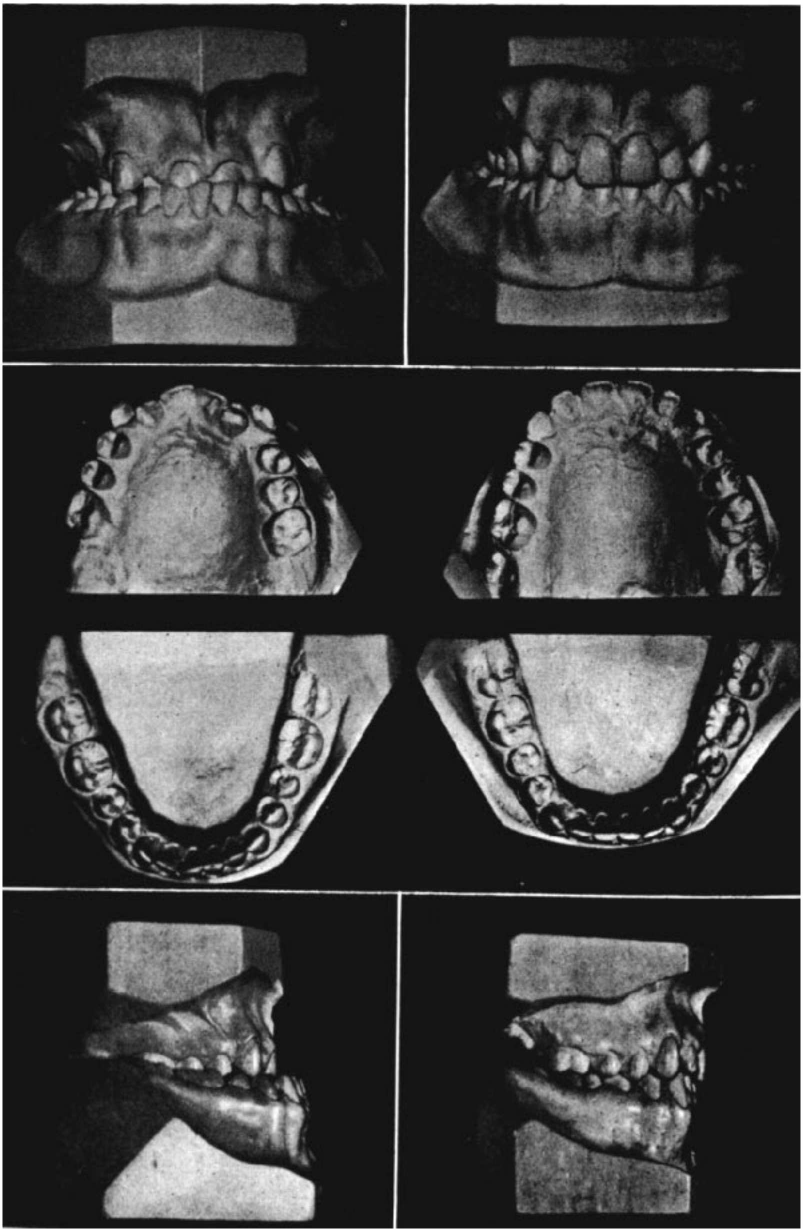
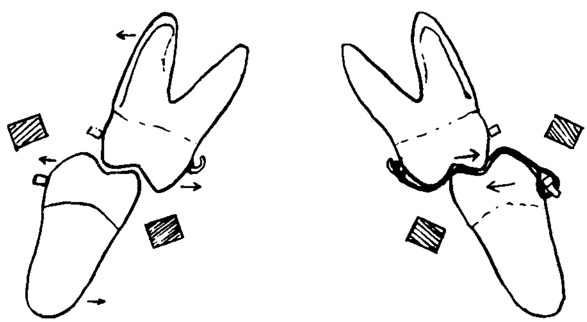


Fig. 29.—Class III malocclusion. Result of treatment shown on right side of illustration.

dental arches and maxillae have been prevented from growing to their normal size. My experience has been that when I endeavor to retract the mandible in older patients, by using the teeth in the maxillary arch for anchorage, the end result seems to be quite like attempting to jump the bite by means of inclined planes in the treatment of Class II malocclusions. Relapse begins as soon as intermaxillary force is discontinued. The mandible virtually seems to walk out again.

My plan of treatment is to correct the perverted bucco-lingual axial inclinations of all the teeth in the buccal segments of both the maxillary and mandibular dental arches; constrict the mandibular arch, which is too broad, and expand the maxillary arch, which is too narrow; and move the maxillary teeth forward *en masse,* utilizing the teeth in the mandibular arch as stationary anchorage.



Torque force correcting perverted axial inclinations of individual teeth in buccal segments of both arches. Action in maxillary buccal segments—roots buccally—crowns to lingual. Action in mandibular segments—roots lingual—crowns buccal.

Cross-bite condition corrected by expansion of maxillary arch-wire plus pull of cross-bite elastic which develops breadth of this arch. Constriction of mandibular arch-wire plus pull of cross-bite elastics decreases breath of that arch. This treatment continued until normal ideal arch form is accomplished.

**Fig. 30.**—The use of correct buccal torque shown diagrammatically in the treatment of Class III malocclusion. Also shows correct positioning of the palatal hooks on maxillary molar bands and the use of cross elastics as explained in text.

All the teeth in both arches are banded in much the same manner as in Class I and Class II cases, except that, prior to cementing on the upper anchor bands, hooks are soldered to their lingual surfaces. The hooks point gingivally but do not contact the soft tissues. (Fig. 30) Preliminary arches of .016″ round steel are inserted, and the patient is dismissed for two weeks.

During the second visit ideal arch wires are made of .021″ x .028″ steel wire for the mandible and .021″ x .025″ for the maxillary. Stops are soldered to the arch wires in order to lengthen the dental arches slightly, which will facilitate the correction of rotations and the gaining of lost spaces, should such adjustments be necessary. Hooks of .028″ round brass are soldered to the mandibular arch wire immediately anterior to the cuspid bracket. Care should be taken not to destroy the temper of the arch wire during the soldering operation.

The lower ideal arch wire is now bent considerably narrower than the ideal; and torque is placed in both buccal segments from cuspid to second molar. The torque is of such a nature that the roots of the mandibular teeth will be moved lingually and the crowns buccally. The lower dental arch in these cases is already too broad, and in spite of the fact that the arch wire has been bent narrower than the ideal, the torque in the arch wire—torque force being greater in the arch wire than contracting force—will have a tendency to throw the crowns buccally, as the perverted axial inclinations of the teeth in the buccal segments are gradually corrected. This tendency toward further broadening of the mandibular arch as the torque force in the arch wire expends its energy is controlled by strong cross-bite elastics, to be described later.

The upper arch wire is bent so that it is considerably wider than the ideal, and is tested and marked for bracket engagements. Torque is incorporated also into the buccal segments of this arch wire from cuspid to second molar, and is of such a nature that the crowns of the teeth will be

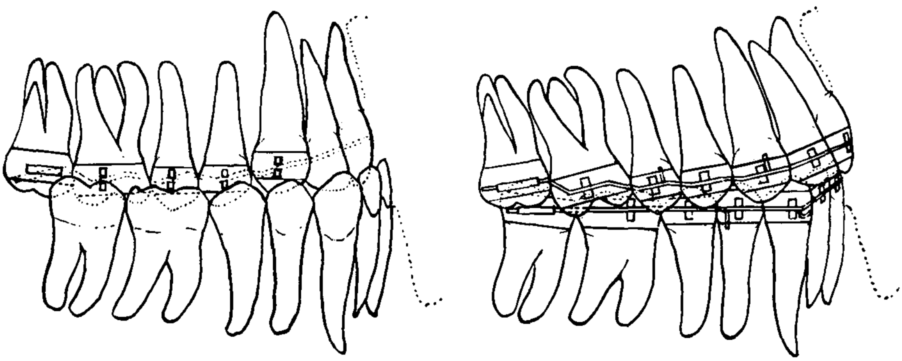


**Fig. 31.**—Step forward bends used in maxillary arch to assist in moving maxillary teeth mesially.

carried lingually and the roots buccally—a movement necessary to correct the bucco-lingual axial inclinations of the teeth. In spite of the fact that considerable expansion is placed in the arch wire, it is nullified by the torque in the arch wire, which will be expending its energy in moving the roots of the teeth buccally, and the already too narrow crown portion of the teeth will be moved lingually. (Fig. 30) Step-forward bends are now placed in the buccal segments of the arch wire at points marked for bracket engagements. The bends are the direct opposite of those described as step-back, or second order, bends in Class II treatment. The bends are so made that the crowns in the buccal segment of the maxillary arch are tipped forward when intermaxillary elastics are worn. (Fig. 31)

The arch wire is now seated by means of the torquing iron and tied into place by steel ligatures. Small but powerful elastics are engaged to the hooks that have been soldered to the lingual surfaces of the upper anchor bands. They are pulled down and across the occlusal surfaces of these teeth, and the other ends of the elastics are fastened to the ends of the arch wires that protrude behind the sheaths of the lower molar anchor teeth. (Fig. 30) These cross-bite elastics greatly aid in swinging the buccal segments of the maxillary arch outward, or buccally, and the corresponding segments of the mandibular arch in, or lingually.

Another set of intermaxillary elastics is worn, fastened at one end

**Fig. 32.**—Treated Class III malocclusion showing result on face immediately after treatment, and the result 8 years after all retention was discarded. The models of this case are shown in Fig. 29.

**Fig. 33.**—Class III malocclusion showing results on the face immediately after treatment, and 6½ years after all retention was removed. Models shown in Fig. 34.

to the distal ends of the maxillary arch wire that protrude behind the sheaths of the upper molar anchors, and to the other by the .028″ brass hooks which have been soldered to the lower arch wire just anterior to the cuspid brackets.

When the cross-bite condition and the perverted bucco-lingual axial inclinations of the buccal teeth have been corrected the arch wires are reshaped to the ideal. Treatment is continued until the maxillary teeth have been moved forward *en masse* into occlusion with the teeth in the mandibular arch.

The treatment I have described will not produce normal occlusion and a perfectly balanced face, but the result will be an improvement over the previous condition which will be gratefully appreciated by the patient, and, particularly in older patients, there will be much less tendency toward relapse of jaw relationships than if an attempt were made to retract the mandible. To move the maxillary teeth forward into protrusion is not what we should like to do, but it is undoubtedly an improvement over the original malrelationship of jaws and dental arches, both functionally and aesthetically. (Figs. 32-33-34)

I am coming to believe that in the treatment of such cases we should resort to extraction of first or second bicuspids in the mandibular arch, particularly in older patients, when the maxillary base is beyond appreciable development.

## BIMAXILLARY OR DOUBLE PROTUSIONS: SECONDARY OR ADULT ORTHODONTICS

A few remarks on the treatment of bimaxillary protrusions, which sometimes complicate the treatment of malocclusion, cannot be avoided. I wish to preface my discussion, however, with a few words of warning. We must always bear in mind that as long as growth and development processes are available in the patient, there is no justification for the sacrifice of dental units in the treatment of malocclusions. Such a practice should never be resorted to before the complete eruption of the second permanent molars, and even then not until every possible hope of conservative treatment has been exhausted.

My experience has shown that the most unstable, and therefore the most difficult patients to retain successfully are those in whom both the maxillary and mandibular teeth are too far forward in relation to their respective bases, or are in double protrusion. In fact, the usual result after years of retention, is relapse, particularly in the lower incisal segment of the arch, and not infrequently the loss of soft and hard tissue adjacent to the labial and buccal surfaces of the teeth. If this is true in your practice as well, it behooves us to be more cautious in our treatment. No truer statement was ever made than this one of Angle's: "The best balance, the best harmony, the best proportions of the mouth in its relations to the other features require that there shall be the full complement of teeth and that each tooth shall be made to occupy its normal position—normal occlusion."

On the other hand, when we are confronted with both a mechanical and a physiological impossibility and find that we have the choice of retaining thirty-two teeth all out of the line of occlusion, thereby wreaking

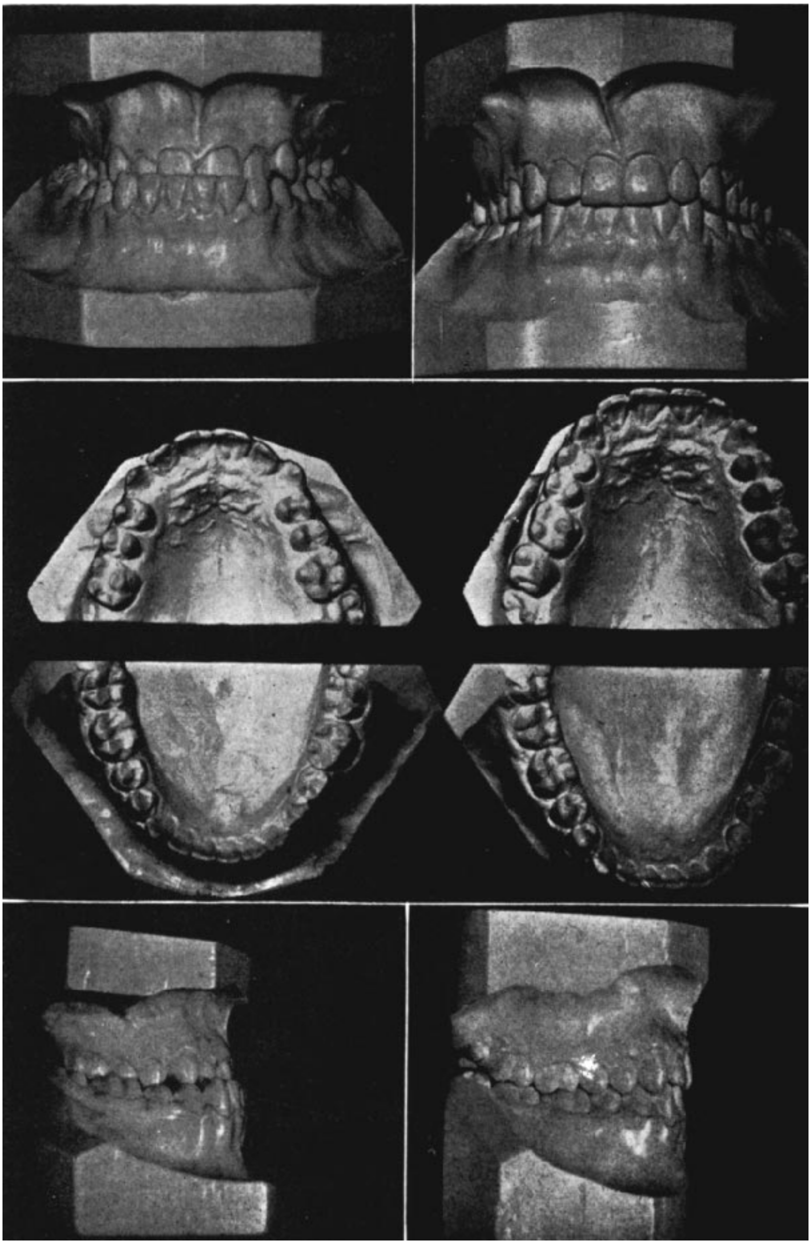


Fig. 34.—Models of case shown in Fig. 33. This is the finest result I have ever achieved in the treatment of Class III malocclusion. The boy is now a freshman dental student in the University of Southern California.

havoc to a face and possibly to a life, or of resorting to the removal of all four first bicuspid teeth and placing the remaining twenty-eight teeth in the line of occlusion, it should not be difficult to decide the proper procedure to follow. There is no branch of the healing art that does not have its limitations, and orthodontics is no exception.

When teeth are in pronounced bimaxillary protrusion and the patient has passed the growth period, I know of no logical method of treatment other than to extract all four first bicuspid teeth and retract the teeth in the anterior segments of both arches by pitting them against the teeth in the buccal segments, utilizing the vertical spring loop and head gear to close the

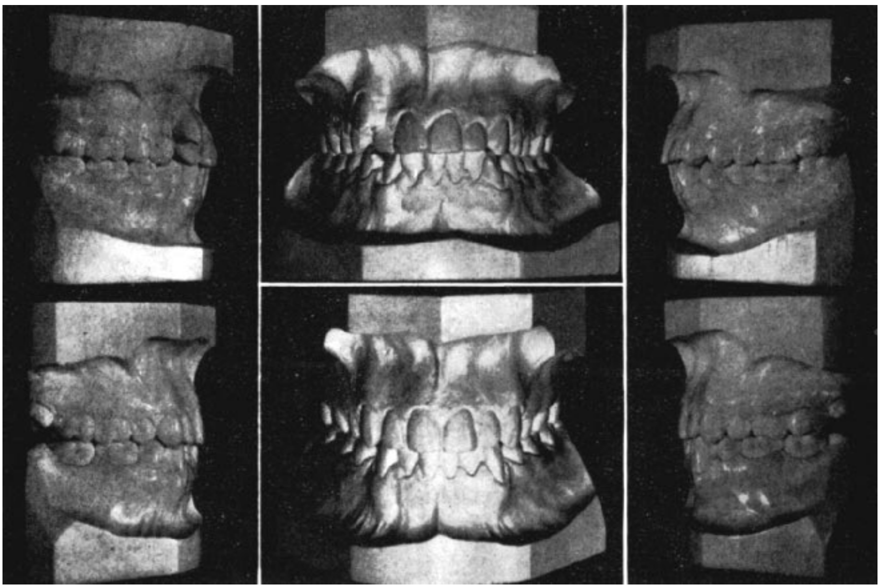


**Fig. 35.**—Models of patient A. Lower models show result of treatment after extracting four first bicuspids. Note the lower incisors over the ridge on lower models compared with upper models.

spaces so as not to displace appreciably forward the teeth in the buccal segments.

When we are faced with the necessity of treating these cases designated as pronounced double protrusions, we must bear in mind that there is a limit both in time and extent to the manipulation of tissue. Otherwise our treatment is likely to be destructive rather than constructive. Whenever it is logical to do so, we should maintain the full complement of teeth. On the other hand, if it is impracticable and we nevertheless do so to preserve our orthodontic ego, at the expense of the general welfare of the patient, we are doing something that is nothing short of malpractice.

At first I shuddered at the thought of sacrificing dental units in the treatment of any malocclusion, but I recalled that at one time Dr. Angle had had the courage to do so. By the time I reached the decision to do likewise shuddering was no new experience to me because, frankly, when

I viewed my handiwork on some of my patients, I had the shakes. I made the decision to resort to extraction fully realizing the reaction that would occur; but I have always remembered the Angle advice on "horse sense." I did not, and do not, extract teeth promiscuously. Rather, I have proceeded with caution.

I first selected two boys, A and B, about sixteen years of age, whose malocclusions were quite similar. (Figs. 35-36) Both were bimaxillary protrusions. Both were treated conservatively for eight months, and A's face was developing into a sorry sight. B's had always been quite sorry. I talked with A's father, and we decided to remove all four first bicuspids. Both A and B were eventually retained. A disappeared from my practice and re-

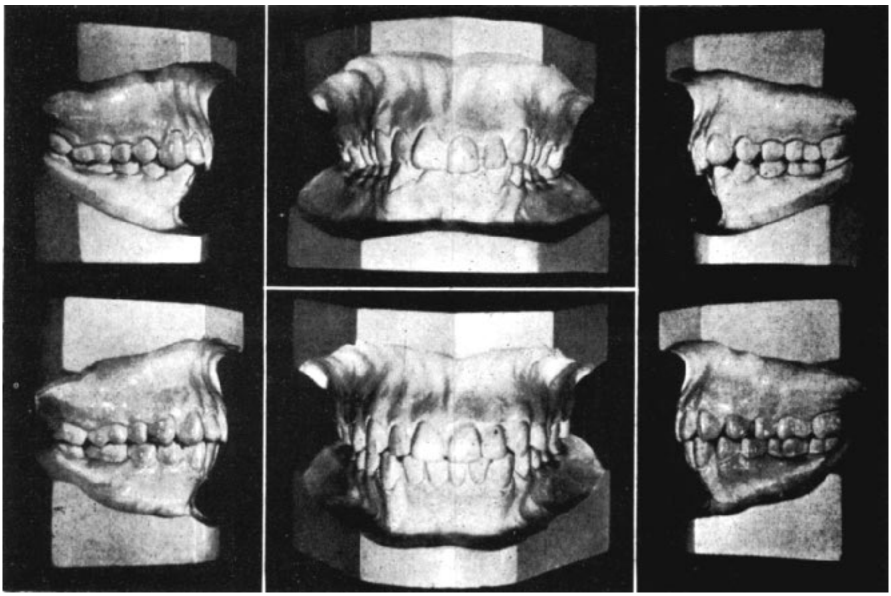


**Fig. 36.**—Models of Patient B. Lower models show result of treatment without extraction of four first bicuspids. Case is in protrusion and the mandibular incisors are leaning off the ridge.

appeared some two years later, confessing that the retainers had become bothersome and that he had discontinued wearing them after about three and a half months. There had been a slight relapse, but in the main his mouth was functionally efficient and aesthetically presentable. B, on the other hand, still has his first bicuspid teeth, and also has had a second period of treatment, and at twenty-three years of age is still wearing retainers with the prospect of certain relapse as soon as he discontinues wearing them.

Years ago I treated a girl, patient C (Fig. 37, left side), placing in alignment the lateral incisors, which were completely blocked out of the line of occlusion, both above and below, and retaining the mouth in double protrusion. A recent follow-up model demonstrates what I have done in this case. (Fig. 37, right side) The early loss of this young woman's denture will be on my conscience as long as I live.

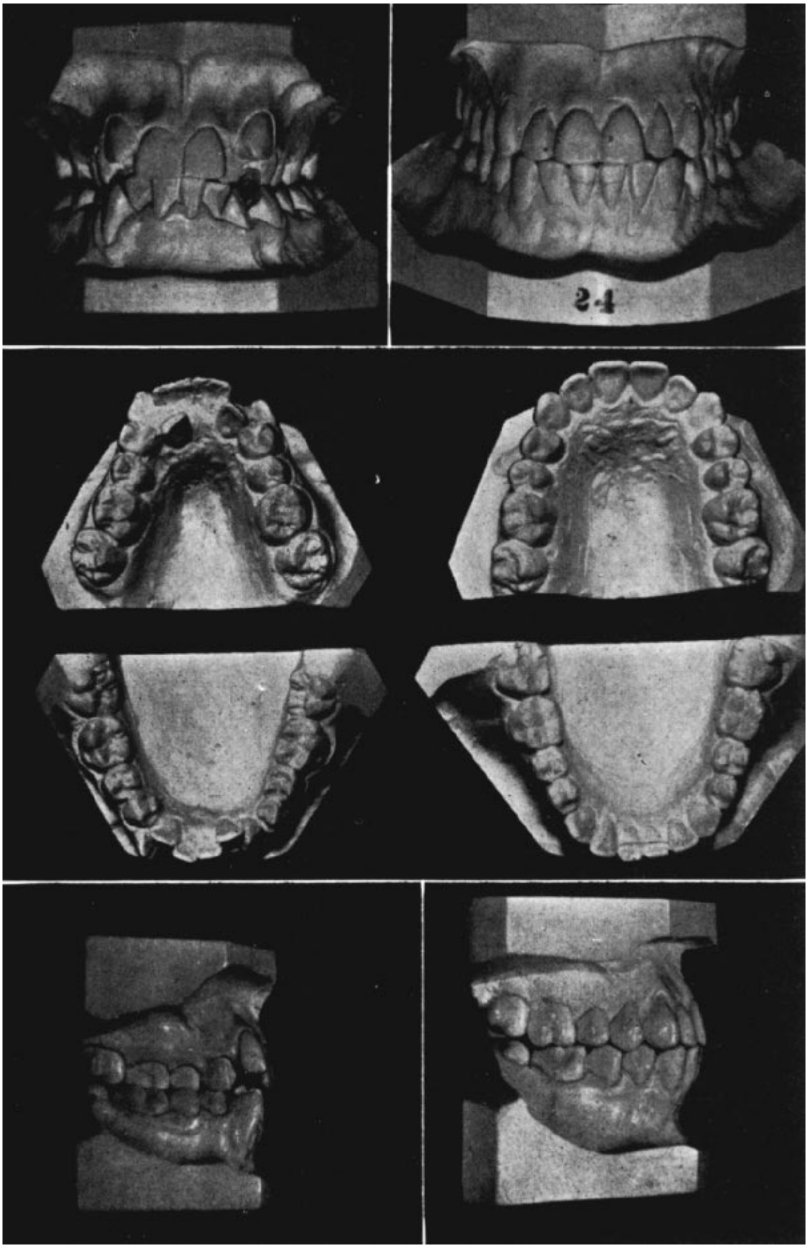



**Fig. 37.**—Models of patient C. Models at left show original condition of malocclusion. *Models at right show treated case 9 years after treatment was completed. Note gum re-*cession on mandibular left lateral incisor and maxillary right cuspid and first bicuspid.

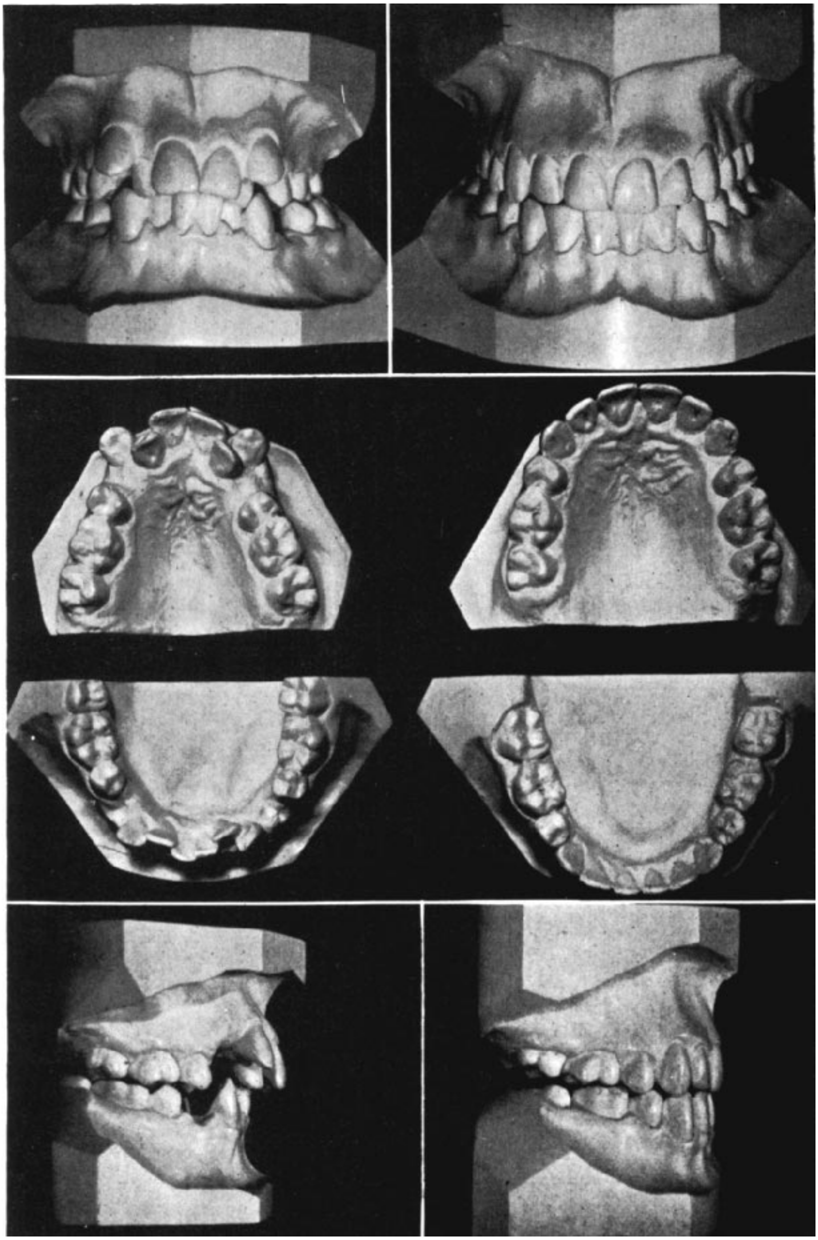


**Fig. 38.**—Models of patient D. Note the similarity of malocclusion to the one in Fig. 37. In this case the four bicuspids were extracted and the anterior segments moved distally. There is no protrusion of either mandibular or maxillary teeth.

I searched for three years to find a similar malocclusion to that of patient C, and found one in patient D, aged seventeen. (Fig. 38) All four first bicuspid teeth were removed in this case and the work was completed in thirteen months. Retainers were worn for less than one year, and the mouth is now functionally efficient and aesthetically presentable, and the investing tissues are healthy. One can see that the maxillary portion of her face does show a lack of development. This defect was in my opinion beyond orthodontic correction, owing to the age of the patient, and could not have been corrected even if I had preferred a bimaxillary protrusion result to the removal of the teeth.

I have been and still am working to perfect a technique that will eliminate the necessity of sacrificing teeth. However, in my opinion it is improbable that such a technique will ever be found for the treatment of patients whose ages range from sixteen to thirty years. They have passed the growth and development period, and we are confronted with the problem of developing bony bases that will not respond to our stimuli.

If we are to deal with the problem effectively, we must reach our patients at a much earlier age during the mixed denture stage, and must learn how to guide intelligently both occlusal and facial growth and development if we are ever to eliminate the necessity of sacrificing dental units. Until that time comes, whenever the scales say the full complement of teeth *versus* balance, harmony, and the rest, I shall be forced to throw my vote in favor of the latter.

For the benefit of anyone who may never have resorted to the extraction of bicuspid teeth in the correction or reduction of double protrusions, let me state that this radical treatment is not the lazy man's way out. More difficulties are encountered in correctly closing these spaces, and far more time, thought, and skill are required, than would have been necessary in merely gaining cusp relationships, overlooking entirely both axial inclinations and facial contour.

When from any cause the teeth in both buccal segments of both the mandibular and maxillary dental arches are forward from their normal relations to their respective bony bases, the teeth are in bimaxillary or double protrusion and the extent of the protrusion is in direct ratio to the distance these teeth have drifted mesially from their normal positions. (Fig. 39)

## Plan of Treatment

After three years of experimenting to ascertain the most efficient manner of closing these spaces, I feel that there is still room for improvement over the method I am now using. However, I shall attempt to describe my present procedure.

If the teeth in the lower buccal segments are bodily forward of their normal positions but in good axial inclinations, the first bicuspid teeth are removed at once. (Fig. 39B) If, however, the teeth in the lower buccal segments incline mesially, it is necessary to correct these perverted axial inclinations before the removal of the first bicuspid teeth is indicated. (Fig. 39A)

Molar bands with their proper attachments are made and cemented to the second molars. Bracket bands carrying mesial and distal staples are made and cemented on all the teeth, including the first bicuspids, which are to be extracted at a later date. Round .016″ steel arch wires are inserted and worn from ten to fourteen days, or until the patient has recovered from the discomfort occasioned by initial teeth movements, which are usually painful.

During the second visit, if the crowns of the teeth are not tipped

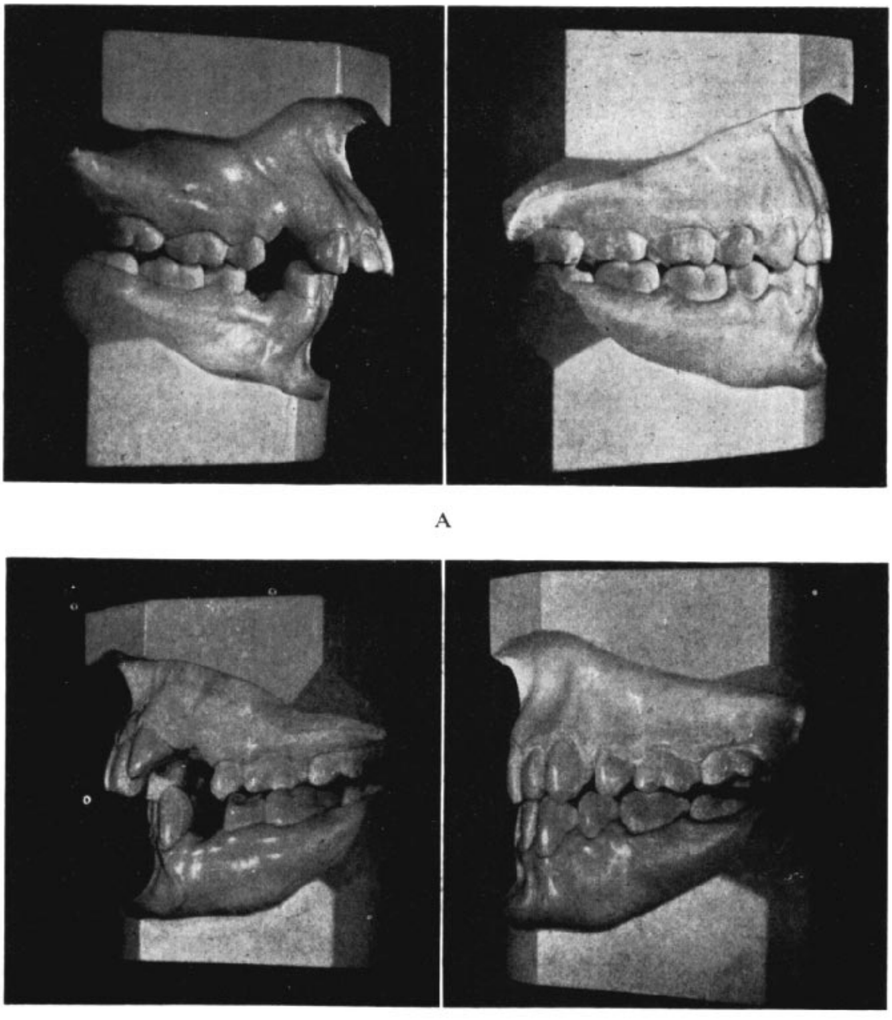
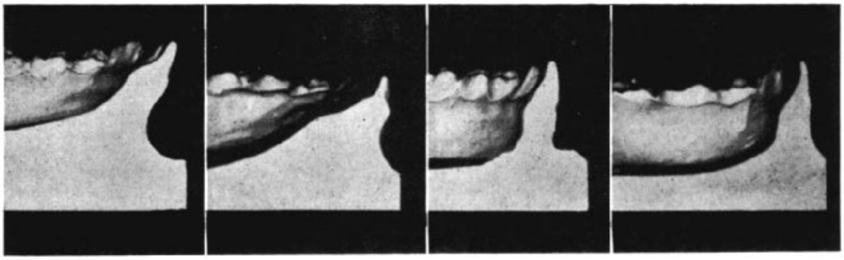


**Fig. 39.**—Bi-maxillary protrusions. A. Where the orbicularis muscle has allowed all teeth to drift forward. B. Where there is a normal functioning orbicularis oris muscle the incisor teeth are maintained on their bony base, but the buccal teeth have drifted mesially. Models at right show results of treatment after extracting bicuspids.

forward to such an extent that it would be imprudent, an ideal arch wire of .021″ round steel or .021″ x .025″ rectangular wire is tied into the brackets of as many of the teeth as conditions will allow, and the patient is dismissed for three weeks. Torque in the anterior segments of the arch wire should



A B C D

**Fig. 40.**—Profile models of mandibular incisors. A. Treated case showing incisors tipped off the ridge. B. Treated case showing incisors bodily displaced off the ridge. C. Non-treated case showing normal positioning of incisors on ridge. D. Treated bi-maxillary protrusion case showing correct position of incisor teeth in relation to the ridge.

be removed before its insertion. The arch wire immediately begins the uprighting of all the teeth in the buccal segments of each arch. (Fig. 42, left diagram)

On the next visit the arch wires are marked for bracket engagement and second order bends of a mild degree are placed in the buccal segments of both arch wires, to upright these teeth further. The patient is then dismissed for another two or three weeks.

With each succeeding visit the second order bends are increased in degree, until the teeth in the buccal segments are sufficiently uprighted to afford toe-hold or proper anchorage, which must be strong enough to resist the force required to move the incisal segments back without appreciably dislodging the buccal segments forward. (Fig. 42, right diagram)

The first bicuspids are finally removed, and as soon as the patient is reasonably comfortable, both maxillary and mandibular arch wires are replaced by .021″ round steel arch wires into which Strang's vertical spring

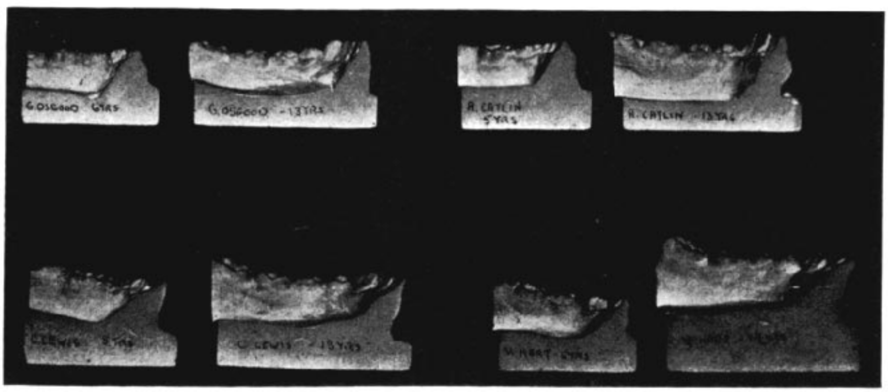


**Fig. 41.**—Profile mandibular arches showing relations of mandibular incisors to the ridge in the deciduous and permanent arches in untreated cases. Note the similarity of axial position of deciduous and permanent incisors. (From the collection of models at the Merrill-Palmer School, Detroit, Mich.)

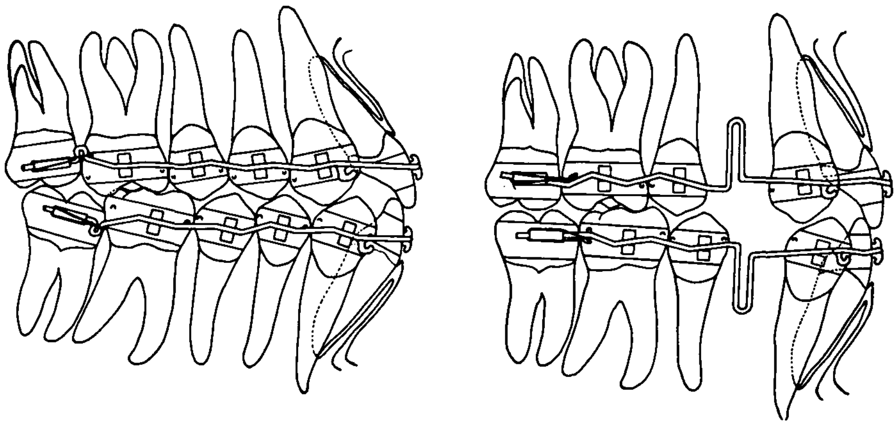


**Fig. 42.**—Left diagram shows buccal segments inclined mesially. These are the cases in which the axial inclination of the teeth in the buccal segments must be corrected prior to the removal of the first bicuspids. Right diagram shows the axial inclination of the buccal teeth corrected, and the bicuspids extracted. Arches with vertical loops are now used.

loops have been incorporated in the regions of the spaces left by the extracted teeth. (Figure 42, right diagram, shows the proper positioning of the loops.)

Broad step-back (second order) bends are incorporated into the buccal segments or the arch wire for the purpose of further kicking back the

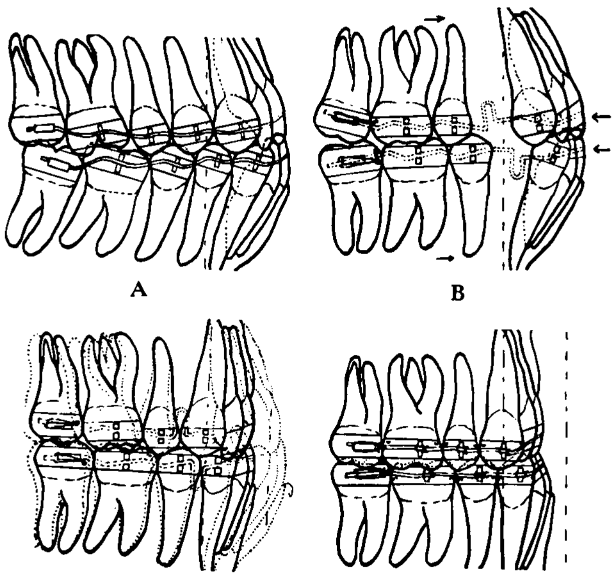



**Fig. 43.**—Diagrammatic representation showing mechanics used in correcting axial inclinations, extraction of bicuspids, and action of vertical loops in closing spaces. Lower diagram shows the application of the continuous ideal arch after the arch with the vertical loops has been removed, and the bicuspid spaces have been closed.

crowns of the second molars, first molars, and second bicuspid teeth, and moving forward their root apices to create anchorage or toehold. The anterior teeth are ligated to the arch wire. The loops are activated by passing a steel ligature wire around the distal end of the molar band sheath and the T on the arch wire. With the ligature tying pliers the loop can be made to open to the desired extent. The arch wire is then seated into the brackets of the teeth in the buccal segments by means of the torquing irons. The areas of the arch wires passing through the cuspid brackets are also marked, and step-back bends are so placed in the arch wires that the crowns of the four cuspid teeth will be forced distally and their root apices mesially. (Fig. 43B)

These cuspid tip-back bends are necessary. Their purpose is to break down the resistance or toe-hold to the distal movements present in the cuspid regions. They convert stationary anchorage into simple anchorage, thereby decreasing the amount of force necessary to move the whole anterior segment back *en masse,* and assuring minimum forward displacement of the teeth in the buccal segments.

As the teeth in the anterior segments are tipped distally, the incisors and cuspids become elevated as they approach the positions in which their long axes are perpendicular to the bodies of their respective bones. To prevent this undesirable elevation of teeth in the anterior segments, compensation in the arch wire is necessary. It is accomplished by offsetting the sections of the arch wires anterior to the loops, in the manner shown in Figure 42, right diagram. The segment of the arch wire betwen the loops is offset in a plane approximately one-eighth inch gingivally from the plane occupied by the bucal segments of the arch wire.

The arch wire is seated and tied into the incisor and cuspid brackets. The portions of the arch wire in the buccal segment planes are pressed gingivally and into the brackets of the first molar and second bicuspid teeth. The tendency of course will be toward some elongation of the first molars and second bicuspid teeth—and more of the latter than of the former —as the six anterior teeth are being depressed. Ligature wires are not applied to the brackets of the banded teeth in the buccal segments at this time.

Before inserting the arch wires, T's, or better, stop-hooks, are soldered to the arch wires. These attachments are located approximately one-fourth to one-half inch in front of the anterior end of the alignment sheaths on the second molar bands. The arch wires are sufficiently long to allow their ends to protrude through the distal ends of the molar band sheaths. Ligature wires are passed around these protruding ends and engage the T's, or stop-hooks, in such a manner that when the ligature-tying plier is applied to the wire the T's or stop-hooks are drawn to the sheath on the anchor band. This action opens the loops, because the previously placed broad step-back bends will allow the buccal segments of the arch wire to slide back through the untied brackets on the first molars and second bicuspid teeth. When the desired tension of the loops has been obtained, the first molars and second bicuspids are ligated to the arch wire. At subsequent visits the ligature wires are removed only from the T's, first molar, and second bicuspid brackets. The loops are again activated after the arch wire has been removed from the brackets of the first molar and second bicuspid teeth. The arch

**Fig. 44.**—Upper photographs made at the beginning of treatment. Center photographs taken when case is retained, without extraction of first bicuspid teeth. Lower photographs show result of re-treatment after the removal of bicuspids to improve facial balance and harmony.

wire is then reseated in the brackets of the teeth in the buccal segments and retied.

Despite our efforts to create toe-hold or stationary anchorage in the buccal segments and to elevate the second bicuspid teeth by offsets in the arch wire, there is a tendency for the second bicuspids to be depressed and tipped mesially as a result of the reciprocal force exerted by the loop when it is opened. Thus the teeth in the buccal segments will drift forward slightly.

I have found that the wearing of small vertical intermaxillary elastics helps to compensate for the depression of the second bicuspid teeth and to aid in maintaining them and the other teeth in the buccal segments in their upright positions, so that toe-hold or anchorage will not be lost. The elastics are engaged over the loops, so that no soldering of attachments to the arch wire is necessary. I find it advantageous to use the arch wire into which the vertical loops have been incorporated as long as the axial inclinations of the teeth in the buccal segments will reasonably permit. When they no longer permit, I switch to continuous arch wires, and by means of second order bends correct the mesial inclinations of these teeth, always keeping the tie wire around the molar sheaths and T spur snugly tied, until closure is complete. (Fig. 43D)

This procedure of alternating the two arch wires is followed until the spaces have been closed.

New ideal arch wires of .021″ x .028″ steel are now made and the final adjustments are completed in the usual way, utilizing the T or stop-hook on the ideal arch to cinch the buccal and incisor segments closely together and to maintain closure of the spaces occasioned by the removal of the first bicuspid teeth. (Fig. 43D)

Should the case require *en masse* movements after the space closure, as in Class II malocclusions complicated by bimaxillary protrusions, the movements can be started as soon as the spaces in the mandibular arch are completely closed and proper anchorage has been prepared in the arch, by tipping all the teeth in the buccal segments distally to create toe-hold. From this point the case can be treated with the mechanics described in the treatment of Class II cases, using the head gear when necessary. (Figs. 44-45-46)

In closing this discourse on the treatment of bimaxillary protrusions, I should like to say a word of caution to those who might be tempted to abuse both orthodontics and the public by the promiscuous removal of teeth. We have not eliminated, nor shall we eliminate, the problem to which I referred in the beginning; namely, that no two of us have the same picture of "the thing behind the thing"—balance, harmony, efficiency, and beauty. It is therefore inevitable, and has been proved clinically, that men such as Steiner, C. Shelden, S. J. Lewis, Lasher, Nance, William Tweed, myself, and others, all trained in the same fundamentals, cannot always agree as to when the extraction of teeth is indicated. However, we all agree that in cases of bimaxillary protrusions, it is at times best to resort to such a measure. My advice is to think, not twice but many times, to weigh the problem carefully and thoroughly, before resorting to this compromise.

Let us all resolve to study more carefully the mechanics possible within

**Fig. 45.**—Upper photographs made at the beginning of treatment. Center photographs taken when case is retained, without extraction of first bicuspid teeth. Lower photographs show result of re-treatment after the removal of bicuspids to improve facial balance and harmony.

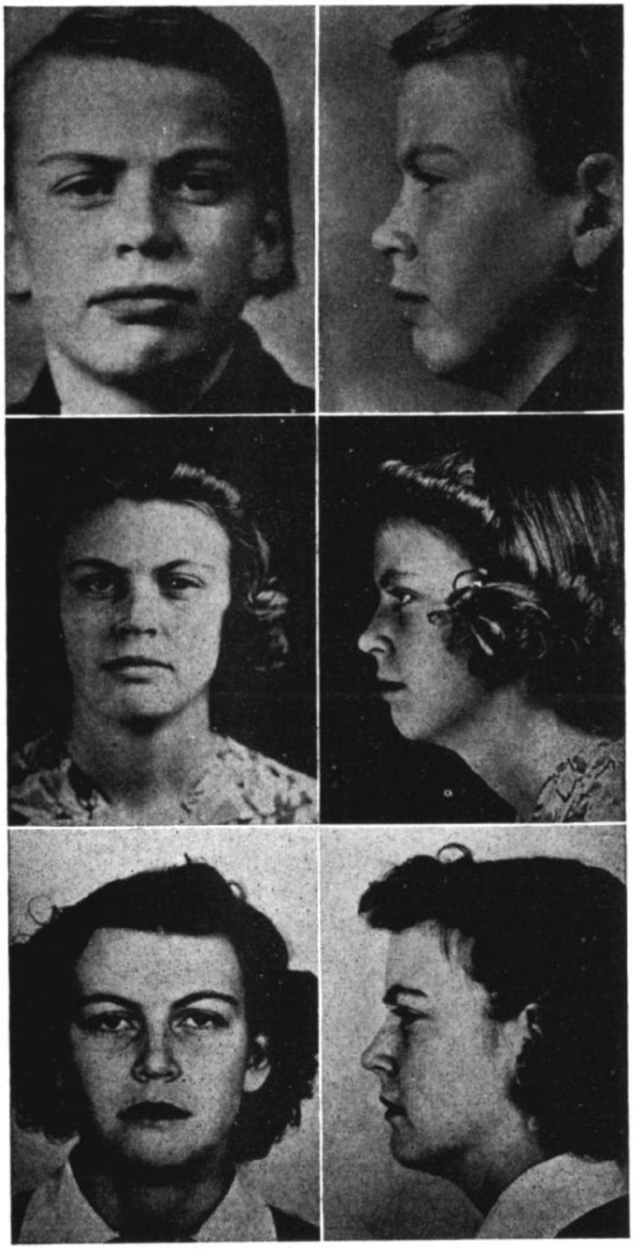


**Fig. 46.**—Upper photographs made at the beginning of treatment. Center photographs taken when case is retained, without extraction of first bicuspid teeth. Lower photographs show result of re-treatment after the removal of bicuspids to improve facial balance and harmony.

this edgewise arch mechanism to the end that we may progress and not stand still or backslide. We must do the thinking, and the mechanism must do the work.

Anchorage, one of the biggest words in orthodontics, is not being utilized to its utmost in applying the principles of the edgewise arch mechanism in the treatment of malocclusions. The result is that we are causing more double protrusions than are necessary. The fault lies not in the mechanism but in our failure to master its potentialities. Try moving the teeth in the buccal segments up and back with second order bends in the arch wire, in conjunction with the head gear and Class III elastics, until you have correctly positioned the mandibular teeth and have established sufficient toe-hold or anchorage. Keep the lower teeth in those positions, and examine the mouth thoroughly every time the patient comes in to make sure that none of them are faltering. If you can keep them in position throughout treatment, which is usually possible, you will find that you have built a good old chin into your Class II cases and that you will have no difficulty in determining which photograph was taken before and which after treatment.

Never again shall I be unmindful of Angle's words: "The study of orthodontia is indissolubly connected with that of art as related to the human face. The mouth is a most potent factor in making or marring the beauty and character of the face, and the form and beauty of the mouth largely depend on the occlusal relations of the teeth. Our duties as orthodontists force upon us great responsibilities, and there is nothing in which the student of orthodontia should be more keenly interested than in art generally, and especially in its relations to the human face, for each of his efforts, whether he realizes it or not, makes for beauty or ugliness, for harmony or disharmony, for perfection or deformity of the face. Hence it should be one of his life studies.

"As orthodontists, we must ever place foremost in importance the normal occlusion of the teeth, for only in normal occlusion is their greatest usefulness possible. But many of our patients would never reach us were it not for the disharmony of their facial lines resulting from malocclusion, and if our efforts are intelligently directed, we can do far more to render plain or even distorted facial lines pleasingly symmetrical or even beautiful than anyone else who has to do with the human face. Indeed, the improvement in proportions and in the artistic effect which may often be wrought by intelligent effort on the part of the orthodontist is marvelous and almost incredible, but his efforts may also result in producing or enhancing ugliness and deformity if unintelligently directed."

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