The Application of the Principles of the Edgewise Arch in the Treatment of Class II, Division 1, Malocclusion*

CHARLES H. TWEED, D.D.S.
Phoenix, Arizona

Part I: The Principle and Technique of Treatment

My paper will deal with the application of principles of the edgewise mechanism in treatment of Class II, Division 1 malocclusions. In presenting the method of treatment of these cases in my practice, the expectation is that the discussion to follow will alter ideas and improve concepts to the end that my treatment will be benefited.

The last of Angle's many mechanical contributions to orthodontia (the edgewise arch mechanism) unquestionably is a vast improvement over any previous appliance ever designed for treatment of malocclusions. Refinement may be possible in the future, but it is difficult to conceive improvements in appliances so far as mechanical principles are concerned. Angle devoted a whole life to evolving the edgewise arch mechanism and then, all too soon, quietly left us to interpret its principles and work out its possibilities.

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 visualized "the thing behind the thing" as a congruent picture. In addition, rarely do we find duplicate conditions involving even very similar malocclusions, and so treatment must vary somewhat accordingly.

Chuck,[1] Lasher,[2] and Steiner[3] demonstrated that, unless guided by mechanical aid, our arch forms all varied—no two of us had the same concept of the normal in this single step of treatment. We could scarcely expect

*Read before the tenth annual meeting of the Edward H. Angle Society of Orthodontia, April 10, 1936, Del Monte, California. This paper is published in two parts, the first dealing with the mechanics of Class II, Division 1 treatment, appearing in this issue, and the second discussing extractions in cases of double protrusion, which will be published in the October number.

1. Chuck, George C., Ideal Arch Form, The Angle Orthodontist, Vol. IV, p. 312, Oct., 1934.
2. Lasher, Matthew C., A Consideration of the Principle of Mechanical Arches as Applied to the Dental Arches, The Angle Orthodontist, Vol. IV, p. 248, July, 1934.
3. Steiner, Cecil C., Orientation of the Teeth and Dental Arches, The Angle Orthodontist, Vol. IV, p. 35, January, 1934.

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 our operative procedure. Each has a definite concept of the normal mesio-distal relationships of the jaws to one another, of the positions of the individual teeth in their 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; and so our methods and our results of treatment inevitably will not be the same, nor will the technical application of the principles of the edgewise arch mechanism in treatment be identical.

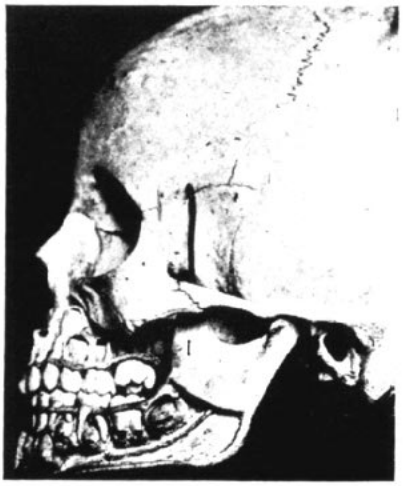


Fig. 1

Fig. 2

Ever present in the back of my head is an image of the profile of a skull and a face, which to me is the normal (Figs. 1 and 2). One glance at an unbalanced face or teeth in malocclusion and there is a comparison before me, as clear as any photograph can depict, between the case involved and my conception of the normal. To many of you my conception of the normal (this image in the back of my head) would not be beautiful if you could see it, because some of you would say this normal of mine has slight Class III tendencies. Typal differences should be considered, but 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 (Fig. 2). Occasionally, when nature has created my idea of the

normal in some individual, my impulse is to pass a hand over it—to feel it so that I cannot forget. Some of you think my normal has a mandible that is slightly anterior to the real normal in its relation to the skull as a whole and that the individual teeth in the mandible are a little too upright or vertical. Yes, the lower incisors and cuspids are so vertical that in the fresh specimen they might even give the impression of retruding slightly. There is no protrusion of the alveolar process in the lower incisal region, and the mandible is firm and prominent (Fig. 1).

Do I always succeed in reproducing this normal of mine? Seldom, if ever, am I entirely successful, but the similarity of relationships displayed by the models before you will demonstrate my efforts to reproduce this image of mine (Fig. 3).

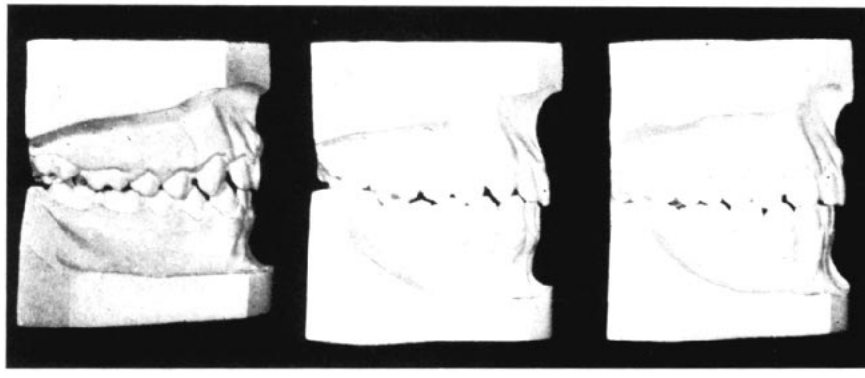


Fig. 3

Treatment

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

When possible, molar bands are made and cemented to the second molars. Tie bracket bands are made for all other teeth, and each band carries a mesial and distal staple.

The Lower Arch—Fortunately, the lower arch in Class II, Division 1, cases is usually characterized by teeth that are more or less regular, and so the bracket bands are cemented to all of the teeth, except those teeth immediately anterior to the molar anchors. In some cases this will be the first permanent molar; in others the second bicuspids.

The Upper Arch—The same procedure is followed as in the lower arch, except that in very pronounced protrusion of the incisors, bands are not cemented in place on these teeth at this time. After .016 round steel arches are inserted, with bends to begin uprighting the anchor teeth, the case is dismissed for from ten to fourteen days for preliminary limbering up of the tissues.

In my opinion it is an error, 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 (Fig. 4). To

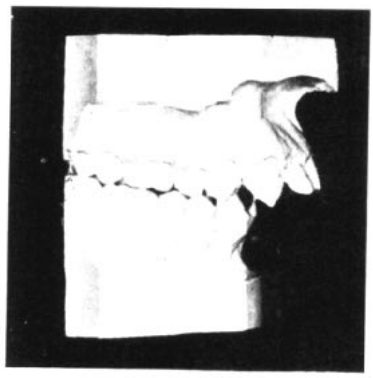


Fig. 4

do so is usually disastrous so far as a reasonably satisfactory approach to the creation of my image of the normal is concerned, the reason being that anchorage is, in reality, upside down. Stationary anchorage exists above in portions of the maxillary arch and must be broken down or converted into simple anchorage, and the so-called stationary anchorage present in the mandibular arch must be reconstructed, reinforced, or augmented by toe-hold, and built into a more stable form of stationary anchorage, prior to endeavoring to move the maxillary teeth back en masse. Unless this is recognized, anchorage intelligently determined, and the preparatory work first accomplished, my experience has been that the result is very liable to be double protrusion through the anterior displacement of the mandibular teeth instead of the distal movement of the maxillary teeth (Fig. 7).

The plan of treatment should be divided into two stages: (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 movement of the maxillary teeth en masse, along with develop-

ment of the body of the mandible without forward displacement of the mandibular teeth.

Lower Arch Preparation—Anchorage—During the second visit, provided the crowns of the lower incisors are not flaring forward with loss of contact, an ideal arch is made of .021 x .024 inch steel. It is necessary to have a .001 inch clearance between the arch wire and our present efficient brackets. The arch is marked, step back bends (of a mild degree at first) are made from molars to cuspids, and slight torque incorporated in the incisal portion of the arch to torque the crowns in and the roots out. The teeth immediately anterior to the anchor teeth have not been banded as yet, in order to take advantage of a longer leverage to tip the molar teeth up and back so as to develop toe-hold.

By accentuating these second order bends at intervals of from two to four weeks, the teeth in the buccal segments are usually made vertical in from eight to twelve weeks. Now further tip the anchor teeth back, bury the distal of the crowns if necessary, and cement in second bicuspid or first molar bands, whichever they may be.

One-eighth of an inch anterior to the alignment sheath, a T is soldered to the arch, and a steel ligature is tied around the sheath and T, to prevent any arch movement through the sheaths, and to keep the teeth in contact. Anchorage preparation should now be complete, and the lower arch is ready to withstand a reasonable intermaxillary pull without having the teeth mush or flare forward.

In mixed dentures that have suffered premature loss of teeth and space, I do 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, I prefer to reduce the mesiodistal dimensions of, or extract the first deciduous molar, and guide the erupting cuspid back at the expense of encroaching on the space for the oncoming first bicuspid. If only the cuspid can be guided into its normal position and banded, anchorage is infinitely increased, and we have something with which to work. If necessary this procedure is repeated, and the second deciduous molar is 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, cuspid, and first bicuspid are in good positions there is sufficient anchorage available to move the molar back enough to gain necessary space for the second bicuspid without displacing the anterior teeth forward into protrusion.

Upper Arch Preparation—Elimination of Toe-hold—The protrusive upper incisors afford a most potent toe-hold or stationary anchorage, and this condition, if present, must be overcome before these teeth are banded and

intermaxillary elastics worn; otherwise undesirable anterior movement of the mandibular teeth is very likely to occur (Fig. 4). Occasionally the upper incisor crowns, in addition to being very protrusive, have open contacts or

Models of this case are shown in Fig. 6.

spaces between them. An arch, either .021 round or square, is made with Strang's vertical loops incorporated in both buccal segments in the region of the second bicuspids or first molars, depending on which molar carries the

anchor band. The anchor teeth are tipped back slightly, and, by means of a T soldered to the arch ⅛ inch in front of the molar band sheath, the loops are made to open or pull by means of a ligature drawing the T towards the molar band sheath. The arch, devoid of bends and having a clearance of .001 inch, will slide through the loosely tied bicuspid and cuspid brackets and tip the crowns of the flaring or protruding incisors back without appreciable movement in the apical region of these teeth; also without much displacement of the molar anchors.

When the contacts have been closed the degree of protrusion of the incisors will have been reduced and an ideal arch will replace the arch carrying the vertical loops. The anchor teeth, having been previously uprighted to prevent their forward displacement in retracting the protruding incisors, are in good position and the second bicuspid or first molar bracket bands, whichever they may be, are now cemented in place.

Second order bends are incorporated in the new ideal arch and after soldering on stops and maxillary hooks the arch is ligated to place, and the patient instructed to wear proper intermaxillary elastics. The incisors are not banded until they have been tipped into favorable positions by the drag resulting from the distal movement of the teeth in the buccal segments of the arch. When and as soon as their axial inclinations have been changed until they will no longer afford a toe-hold or drag, or when there is little danger of appreciably dislodging the root apices forward, they are banded and tied to the arch.

Perhaps this is the time to digress slightly and give a more detailed explanation as to why these protruding incisors should not be banded in the beginning of treatment. Most of us agree that prior to treatment the root apices of the 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—hence the apices are nearest their normal positions.

When these teeth have been banded and bracket engagement obtained with a square arch wire which has been 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, and from this instant, these teeth, if moved, are carried back bodily through bone in relatively their malposed axial positions. Surely one can visualize what is most 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, and the end result is probably a Class I cuspal relationship and a Class II jaw relationship. Some operators say they torque the incisor

crowns back and the roots out in the maxillae to prevent drag, but none of us can say, if this is done, 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. This, however, seems quite certain: when torque force is spent the incisor teeth attached to the arch wire no longer being tipped, and they begin to drag or create toe-hold or stationary anchorage against distal movement of the maxillary teeth en masse, which begins to strain anchorage in the mandibular arch. During this procedure of torquing the incisor roots out and the crowns in or back, and finally the root apices back again, the whole tooth has been going "round and round," as it were, which certainly is not physiological tooth movement and not infrequently is conducive to root resorption.

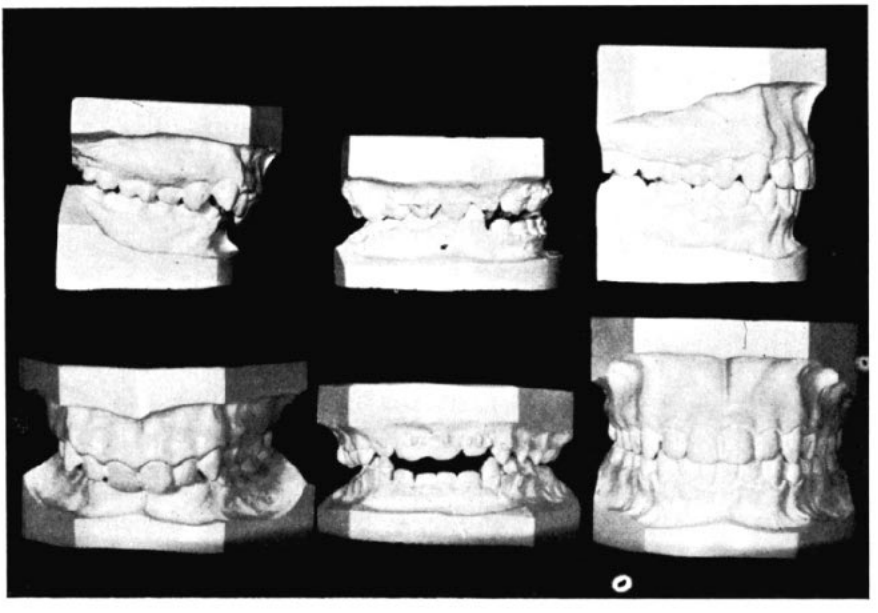
The use of a .021 round arch wire would, of course, be more logical than a square wire if the protruding incisors are to carry bracket bands at the beginning of treatment. The long axes of these teeth are not always parallel to the median line, nor is the arch form in this region a straight line, and so even with a round wire some drag will be occasioned by the very positions of these teeth that will tax anchorage in the mandible, of which, I can assure you, there is never too much. 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 their approximate correct axial positions by drag caused by the distal movement of the maxillary buccal segments, utilizing second order bends and proper intermaxillary elastics.

The maxillary hooks that have been soldered to the arch should be anterior to the cuspid bracket. They should be as long as occlusion will allow, so that the angle of pull will be decreased, in order to minimize orientation of the line of occlusion. Up and down rubbers in the region of the cuspids are used, in addition to a slow Class II rubber, if the depression of the lower incisors and elevation of the lower molars has a tendency to open the bite. This 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 that anchorage below is not strained, and so that we secure the maximum in mandibular development and the minimum anterior displacement of the lower teeth.

When a normal mesiodistal jaw relationship has been established and checked to make certain of its permanency, some of the degree of second order bends can be removed from the arch, and such alterations of the axial

inclinations of the moved teeth made as deemed necessary by the operator.

Occasionally, after the establishment of a normal mesiodistal jaw relationship and proper cuspal relations, an examination of the front and profile will disclose 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.



a b c

Fig. 6

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

The arches are cut between the cuspids and lateral incisors. The ends of the segments in the maxillary arch are turned up and disked smooth. In the lower arch they are turned down and likewise smoothed.

A large intermaxillary elastic is hooked around the distal ends of the arches, 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 segments of the arches, both above and below, to form an oblong figure, with up and down pull in the molar and cuspid regions of the buccal segments of each arch. With the bite plate in place, the buccal segments on each side are drawn together at the rate of one-eighth inch each two months. If more vertical development is deemed necessary, the bite plate is altered to the desired extent of opening, and the process continued. When, in the judgment of the operator, the desired amount of vertical development has been accomplished, the bite plate is further worn for from three to four months to allow proper osseous development around the roots of the teeth in the buccal segments. After the bite plate is removed, the space between the upper and lower incisor segments will be from one-

Fig. 7

eighth to one-fourth inch, depending upon the amount of vertical development that has been accomplished (Fig. 6-b). A large elastic is now passed around the ends of both upper and lower sectional arches that protrude from the distal of the lateral incisors, to form a square figure with up and down pull. This elastic is worn until the anterior segments are brought into their proper positions, when the segments of arches are replaced by ideal arches above and below, and the final adjustments made prior to retention (Fig. 6-c).

The case is retained in the customary manner.

Many times have we heard orthodontists remark, "Some of my beginning photographs look better than the pictures of my treated Class II's and it sometimes requires years for them to get chin development." We all have some like that, only mine usually never seem to develop much chin. However, I think I now know why.

In the beginning of my career as an orthodontist, I had the mistaken idea that if each tooth was carefully banded, ideal arches with second order bends in the upper arch inserted, intermaxillary elastics applied, irregularities corrected, and Class I cuspal relationships gained, that this little mechanism would do, in addition, all the thinking for me. How I was fooled. Every so often the mechanism would rebel and would not react as it did in most cases under apparently identical conditions. I would worry along, and finally wind up with an underdeveloped mandible and a horsey looking set of teeth. Why? Because I did not diagnose, study, plan, and prepare proper anchorage. The mandibular and not the maxillary teeth were the ones that did the moving (Fig. 7).

The picture is clearer now, somewhat late for my peace of mind, and I will no longer abuse this efficient mechanism by trying to use it as a modified E arch. Perhaps, and I hope so, the light has come to you earlier than it did to me, or else you too lie awake at night regretting.[1]

(To be continued)

1. Part II, "A Discussion of Extraction in the Treatment of Marked Double Protrusion Cases," will appear in the October number of The Angle Orthodontist.