

# THE REMOVABLE LINGUAL ARCH AS AN APPLIANCE FOR THE TREATMENT OF MALOCCLUSION OF THE TEETH\*

BY JOHN V. MERSHON, D.D.S., PHILADELPHIA, PA.

IT is a well-known biological fact that to have normal development of the tissues and organs of the body, we must have normal function of these tissues and organs during the process of development.

Anything interfering with the forces which produce these functions will interfere with the functions, and just in proportion as we have a disturbance of function we will have a disturbance in development.

Malocclusion of the teeth or maldevelopment of the facial bones is quite likely the result of a perversion of or some interference with these functional forces, and the orthodontist is endeavoring to correct these deformities and restore these functional forces with orthodontic appliances. These appliances are effective just in proportion as they apply force in the direction of normal growth, and in so doing do not interfere with the function of any of the tissues associated with the teeth, or with the teeth themselves collectively or individually, each tooth being left free to functionate normally.

The direction of normal growth of the teeth and facial bone are, forward, outward and downward in the upper jaw: forward, outward and upward in the lower jaw.

The appliance in which the application of force is in these directions and which does not interfere with any of the associated functional forces, would be the ideal appliance. I am going to ask your consideration of the removable lingual arch as the appliance which seems to possess many of these qualities.

Occupying a position on the lingual surface of the teeth and at the gingival border, with all the teeth free to functionate normally (except the two molar teeth to which the arch is attached), the appliance develops a force which operates from the lingual side and is in the direction of normal growth, and the muscles of the lips and cheeks are left free to functionate normally.

## THE ARCH

The removable lingual arch is a wire of suitable size, to which auxiliary springs can be attached, adapted to the linguo-gingival surfaces of the teeth, and bent to conform to all the inequalities of the dental arch, produced by the irregularities of the teeth. It is fastened to the lingual surfaces of the molar bands by means of the Young-Angle lock with certain modifications. This lock has proved most valuable to the profession, and we are greatly indebted to the developers of it. I have modified it by using a half round tube in place of the elliptical one. The lock is a wire soldered mesial to the tube, instead of being formed by bending the portion of the arch which is distal to the tube to change it gingivally.

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## CONSTRUCTION OF THE ARCH

The arch is constructed on a plaster model made from a good impression, bands having been previously fitted to the anchor teeth (usually the first molars). These bands are transferred to the corresponding teeth on the plaster model, with half round tubes soldered at the proper location on their lingual surfaces.

## BENDING THE ARCH WIRE

We start at the half round tube, allowing the arch wire to extend about one eighth of an inch, distally beyond the tube. Just mesial to the tube we make a compound bend in the wire, first to the gingiva, then again bending the wire parallel with the gingiva, and continuing along the lingual surfaces of the teeth, as close to the gingiva as possible, without impinging on the same, adapting the wire to all the irregularities of the dental arch, until the tube is reached on the anchor band on the opposite side, when the arch is cut off one eighth of an inch distal to the tube.

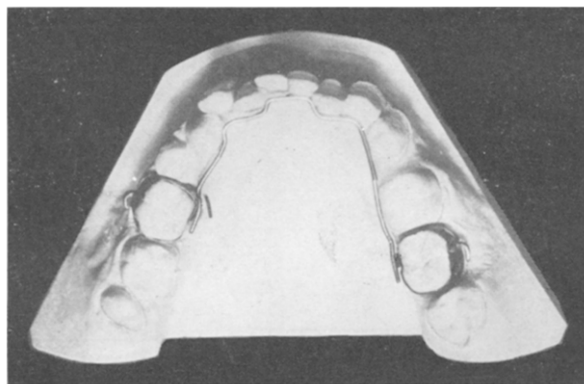


Fig. 1.—Lingual arch bent to conform to the lingual surfaces of the teeth.

## LOCATION OF HALF ROUND TUBES ON MOLAR BANDS

The tubes should be placed on the lingual surface of the anchor bands, usually in the center of the band meso-distally in both upper and lower jaws. In the lower they should be placed as near the occlusal edge of the band as possible, allowing only sufficient distance between the occlusal edge of the band and the top of the tube for the arch. This is so placed for the reason that the post is easier to place in the tube if it is not too far toward the gingiva, as it is difficult to see the tube in the lower on account of the tongue and saliva. In the upper jaw, the tube should occupy the same position meso-distally, but should be placed as near the gingiva as possible, otherwise the lingual cusps of the lower molars will come in contact with the arch, and the continuous biting on it will eventually cause the arch to break.

## SOLDERING OF THE HALF ROUND POST

The post consists of a half round wire soldered to the arch and accurately fitting the half round tubes forming a portion of the lock.

For convenience in soldering, a long piece of half round wire is selected.

Place the arch accurately on the model, mark the arch opposite the tubes, then solder the post to the arch opposite the mark, in the usual free-hand manner, cutting off the half round wire just a little shorter than the tube, leaving a catch for the lock wire. Then place the half round post wire in the tube on the molar bands on the model. If the arch should not lie correctly on the model, remove it, and with two pairs of the Young pliers it can be twisted to the desired position. Proceed in the same manner soldering the half round post wire on the opposite side. The arch is again replaced on the model with both pieces of the half round post wire in the tubes. If the arch should not be well adapted or be raised away from the model, direct the flame of the blow pipe on the arch, heating it to a cherry red, and while hot, pressing with a suitable instrument on the arch it can be readily adapted to the model.

The lock consists of a wire of suitable size, soldered to the gingival surface of the arch, twenty one hundredths of an inch mesial to the half round post, passing it distally to catch under the gingival surface of the tube, thereby preventing the post coming out of the tube. After polishing, the arch is now ready to place in the mouth. Remove the anchor bands from the plaster model

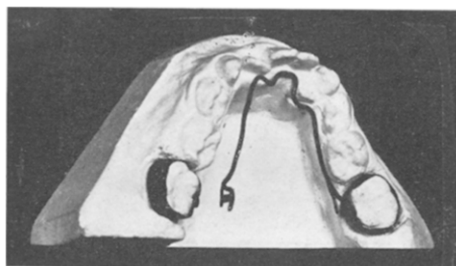


Fig. 2.—Trying in the arch, showing incorrect position.

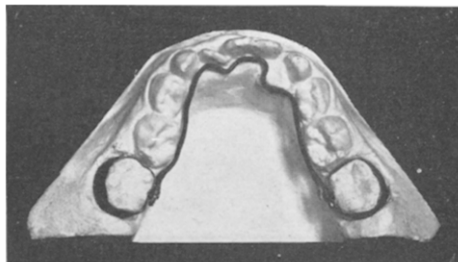


Fig. 3.—Trying in the arch, showing correct position.

and cement them on the teeth. In trying the arch in the mouth, grasp the arch on the left side in the region of the half round post, with a pair of Howe pliers, and place the post in the tube on the left side. The arch should lie in its proper position, with the half round post on the opposite side parallel with the half round tube. Should it not fit properly twist or bend the arch until it lies correctly (Fig. 2). Remove the post from the tube on the left side, then place post on the right side in the tube. If the post on the left side drops in place in the tube, then the arch is ready to be locked in place (Fig. 3).

#### MATERIAL AND SIZES

The size of the wire for the arch which has proved most satisfactory is thirty-six one thousandths, or nineteen gauge B. & S. For the lock, twenty-six one thousandths is used. The half round tubes are ten one hundredths of an inch long, and the post wire sixty-four one thousandths by thirty-two one thousandths.

The arch wire should be hard, with a good spring, and sufficiently tough to stand bending and rebending, also to stand stretching with the pinching pliers without breaking. It should also possess the quality of softening by anneal-

ing, and retempering again, and be sufficiently high fusing to stand soldering with a high carat solder. Some of the gold and platinum alloys on the market today possess all these qualities; the half round tubes, the post wire, and the wire for the auxiliary springs, are all of the same material as the arch itself.

#### THE AUXILIARY SPRING

These springs are wires usually twenty-two one thousandths of an inch, soldered to the main arch wire to produce individual tooth movement.

#### PROPER LOCATION OF THE ARCH

The arch should occupy a position on the lingual surface of the teeth as close to the gingiva as possible, and made to conform to all the inequalities produced by malocclusion.

#### THE USE OF THE ARCH

I shall only consider treatment in so far as it consists of general arch development, and tooth movement in the individual arches.

The arch when first placed in the mouth should be passive, the patient be-

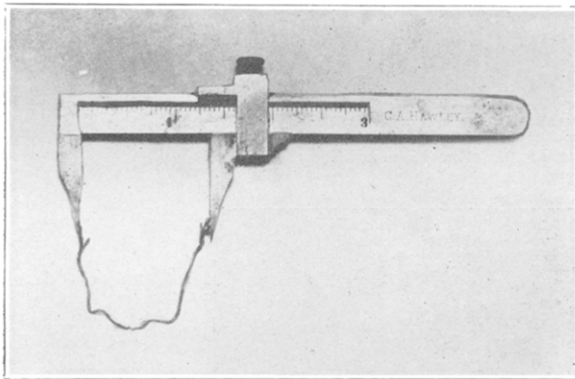


Fig. 4.—Illustrating method of measuring with Hawley calipers.



Fig. 5.—Showing arch after kinks had been taken out. Same arch as in Fig. 1 with bends taken out.

ing allowed to wear it long enough to become entirely accustomed to it which is usually a week.

During this period children are more likely to play with the arch with the tongue, or fingers than thereafter. Therefore, very strict caution should be given both patient and parent regarding this evil, as well as against eating sticky candy. After these precautions, I seldom have trouble, but should I have trouble at the next visit I fasten the arch with a fine ligature wire to some favorable tooth and this usually cures the trouble after the patient becomes accustomed to the appliance. I seldom find it necessary to band teeth to keep the arch in place.

#### TREATMENT

The force necessary to produce tooth movement with the lingual arch is obtained in three ways. One by straightening out the inequalities in the arch

wire; another by auxiliary springs soldered to the main arch; a third by stretching the wire by means of the wire stretching pliers.

After removing the arch from the mouth the procedure of adjusting it consists of taking a measurement of your arch from one post to the other (Fig. 4). This is most important, and is best accomplished by a pair of measuring calipers such as Dr. Hawley used with his charts.

After this is done, retain the calipers for measuring before replacing the arch. I have above stated, the arch must conform to all the inequalities produced by the irregularities of the teeth which necessitates a great many bends and curves in its length. We now proceed to take some of the bends and curves out of the arch (Fig. 5). This is best accomplished by a suitable pair of flat-nosed pliers. Each time you remove one of the bends or curves the



Fig. 6.—Same model as Fig. 1 after 15 months' treatment.

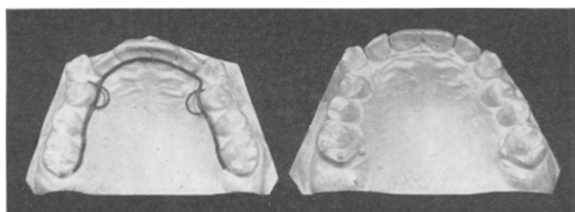


Fig. 7.—Spring method of rotating upper first bicuspids. A. Showing springs in position. B. Showing results of two treatments.

size of the arch is increased. When you replace the arch, by placing the posts in the half round tubes there is a general forward and outward pressure on all the teeth, that require moving outward or forward (Fig. 6). Your object at each treatment is to conform the lingual arch more nearly to the shape you expect the dental arch to be when completed. It is astonishing how little change is required at each treatment. As you straighten out a curve which was toward the lingual to conform to a tooth that was lingually placed, on replacing the arch the most pressure naturally comes on that tooth, and it is in this way that we obtain an outward pressure. After making the adjustment in the arch, before replacing it in the mouth, always measure across from one post to the other with the calipers with which you have previously measured, and set, noting that you have made no change in this region, unless you wish expansion of the molars. After making this change in the arch, it is interesting to note

that when replaced in the mouth and locked into position, the arch will push a little harder on the teeth you wish to move into the line of occlusion with a beautiful reciprocal force. Continue in this manner from time to time, either broadening or lengthening the arch or both as desired, until the teeth have been moved to their desired position.

#### AUXILIARY SPRINGS

These springs are usually soldered to the gingival side and at right angles to the main arch, and are then bent in the direction in which you wish to apply force. The reason for soldering the springs at right angles to the arch and bending them is, that in soldering, the high heat removes the temper from the wire, while the bending to correct position restores the spring temper. The general developing and shaping of the dental arch is best accomplished by the reshaping of the main arch.

Individual tooth movement is best accomplished by the individual springs

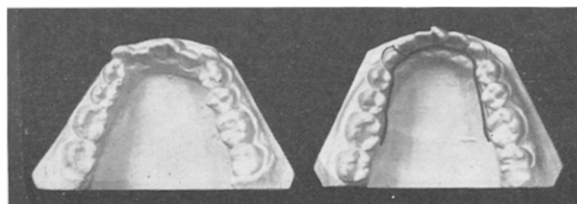


Fig. 8.—Showing rotation of cuspid without bands by the use of auxiliary springs. A. Original model. B. Showing cuspid rotated.

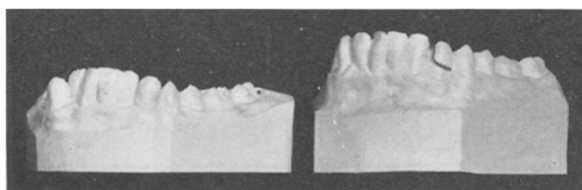


Fig. 9.—Front view of Fig. 8.

#### ROTATIONS

For rotation without banding the teeth let us take as an example the upper first bicuspid which frequently erupts with the lingual cusp rotated mesially (Fig. 7). This is very easily corrected by soldering a spring to the main arch, opposite the approximal space between the first and second bicuspid. Bend the wire mesially forming a half circle, with the free end of the spring wire engaging the first bicuspid with pressure on the mesial surface opposite the lingual cusp.

The spring wires are quite long and you can give a good deal of spring to them, and on account of the small gauge of the wire it will be a very gentle force, effective for a long period of time, often as much as two months.

Rotated cuspids can in many cases be corrected without banding the teeth. Allow the lingual arch to rest with slight pressure against that angle of the tooth which is rotated toward the lingual (Fig. 8). At this point solder

a wire spring pointing occlusally, bending the spring wire labially to pass between the cuspid and the adjoining tooth, and continue the bending toward the gingiva, allowing the loose end of the wire which has been properly shaped therefor to engage with pressure the labial portion of the cuspid which is rotated labially. (Fig. 9.) A large proportion of such rotations can be corrected in this way.

A method employed where the case can be seen infrequently is to band the tooth to be rotated in the usual way, with a spur attached to the labial side of the band, (Fig. 10). A spring wire of twenty-six one thousandths is soldered to the arch some distance from the tooth to be rotated and the spring is bent almost parallel with the main arch. On the loose end which should now stand some distance from the arch, place a fine ligature wire, which passing through



Fig. 10.—*A.* Showing auxiliary springs for rotations when a case can be seen infrequently. *B.* Showing result after being wired once and allowed to remain a number of months.

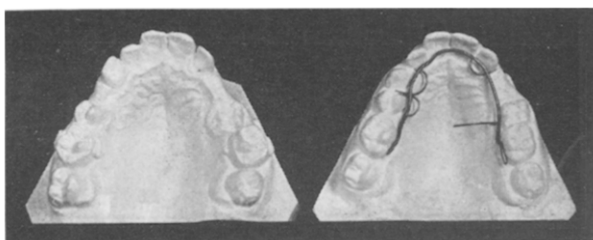


Fig. 11.—Method of opening spaces with auxiliary spring. *A.* Showing spring in place, with the straight one showing how they should be soldered before bending. *B.* Showing result of treatment.

the gingival space, engages the spur on the band. After this the ligature wire should be tightened until the spring is in contact with the main arch. It is well to make a bend at the end of the spring wire so the ligature will not slip off. The tendency of the spring wire to return to its original position will cause the tooth to turn on its axis.

#### ANTERIOR ROTATIONS

To rotate central and lateral incisor teeth, use a grass line by ligating the tooth, then passing one end around the arch and back through the gingival space tying the two ends firmly together. The contraction of the grass line will cause the tooth to turn. In younger cases the lingual arch will frequently correct a rotation of the anterior teeth, simply from the light pressure of the arch resting on the corner of the tooth rotated lingually.

The lips being free to functionate are pressing on the labial portion of the same tooth and are assisting in correcting the rotation.

#### ROTATION OF THE FIRST MOLARS OR ANCHOR TEETH

Of all the teeth, the correct rotation of the first molars I consider the most important. When they are used as the anchor teeth, this is easily accomplished by making a very slight bend in the arch wire where the half round post is attached. The molar roots or crowns can also be tipped buccally or lingually by grasping the arch mesial to the post with a pair of Young Pliers. At the same time with another pair of pliers grasp the arch where the post is soldered to the arch,

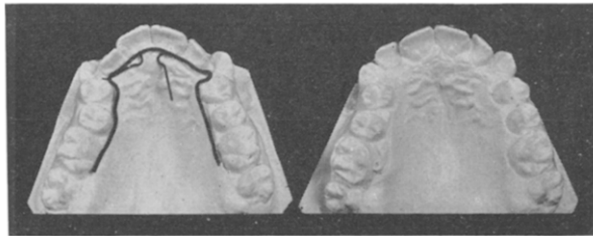


Fig. 12.—A. Showing auxiliary springs for labial movement of laterals, one in correct position, the other just before bending in correct position. B. Showing result of treatment.



Fig. 13.—For mesial or distal movement of anterior teeth.

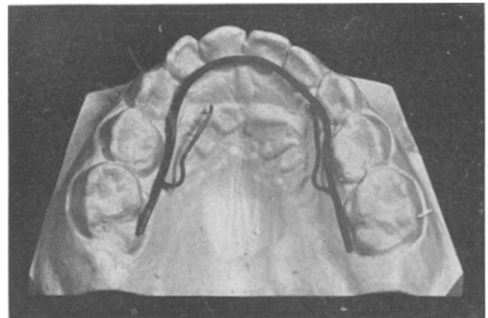


Fig. 14.—Auxiliary springs for lateral development in deciduous denture.

giving a very slight twist in the direction you wish the movement, caution always being taken that you do this exceedingly slowly or you may cause your anchor teeth to loosen. This precaution should be taken at all times in using the lingual arch, as it is very easy to place great strain on your anchor teeth.

To overcome this it is wise to solder a spur on the arch to engage the mesial surface of the first bicuspid. This greatly relieves the strain on the molars, as you can increase or diminish the pressure of the spur at will.

#### TO OPEN SPACE FOR IMPACTED TEETH OR MISSING TEETH

This is accomplished by two auxiliary springs, soldered to the arch, one the width of a tooth distal to the place you wish the space, the other the

width of a tooth mesial to the space, making the two springs the width of two teeth apart. The one most distal curves mesially to engage the one tooth, while the mesial one curves distally to engage the other tooth. (Fig. 11.)

The spring should always be soldered at right angles to the arch before bending into the half circle.

With the loose end of the spring flattened by diskling the sides, this end usually passes to the gingival side of the arch to engage the teeth.

#### LABIAL MOVEMENT OF TEETH

To move laterals labially a spring is soldered to the arch, opposite the median line, then bent to the right or left to engage with pressure the lingual surface of the lateral that is to be moved. (Fig. 12.) To move the anterior teeth mesially or distally, solder a spring to the arch about fifteen one-hun-

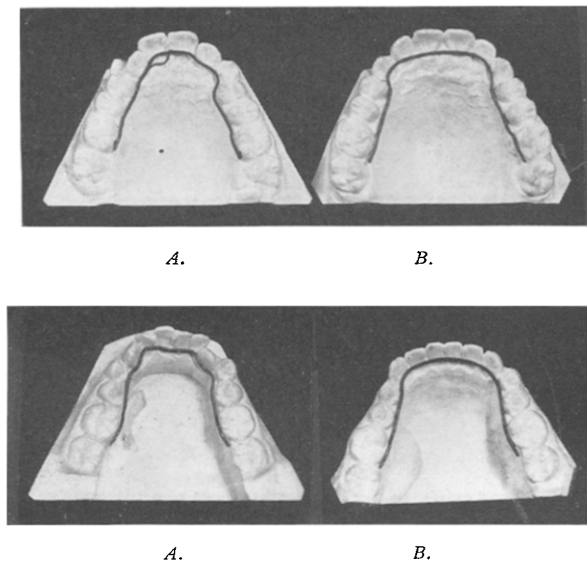


Fig. 15.—Showing case before and after treatment. A. Original model. B. Same model and arch after treatment.

dredths of an inch distal to the tooth to be moved. (Fig. 13.) Bend the spring in a curve passing the loose end, which should always be flattened by diskling both sides until it is very thin, to the gingival side of the arch, and if properly adjusted (this is most important in all of the auxiliary springs) it will pass between the tooth and the soft tissues at the gingival space in the same manner as a thin band. Tooth movement is very easily accomplished if slight pressure is applied to the tooth by tightening the spring from time to time.

The auxiliary spring is very useful with the deciduous denture where we are desirous of obtaining lateral development from one deciduous cuspid to the one on the opposite side. (Fig. 14.) Adapt the arch to the lingual surfaces of the teeth, soldering springs on both sides to the gingival side of the arch, as near the lock as possible. Bend each spring wire parallel with the

arch to engage the deciduous cuspid by flattening the end of the spring and bending it toward the gingiva to fit around the linguo-gingival ridge of the tooth. With the proper adjustment of the springs the desired development can be obtained.

One very interesting feature of the lingual arch is that in moving teeth you seldom have tipping of the teeth, and when you do it is very slight; that is, unless you have been unwise and hurry your work faster than normal development.

The reason the teeth do not tip probably the fact that the arch occupies a position to the lingual of the teeth at the gingiva, pressing forward or outward or both as you desire, with the lips and cheek muscles left free to functionate normally, and every contraction of these muscles causes pressure on the incisal edges of the teeth. Every tooth left free to receive the normal occlusal impact during mastication, produces a normal functional bone development causing the teeth to be carried bodily forward.

In a great many cases the amount of wire from one half round post to the other is just the amount desired. (Fig. 15.) If it should not be sufficient, the one-eighth of an inch that extends beyond the tubes can be utilized by unsoldering the post and resoldering as far distal as necessary to give the de-

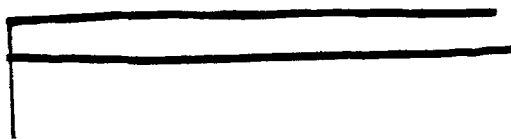


Fig. 16.—Arch wire in case in Fig. 15, lowers straightened out, showing difference in length of wire from distal surface of first molar on the completed case, and the case when started, showing how much is gained in length by straightening out the loops.

sired length of arch. (Fig. 16.) If for any reason this is not sufficient, or in case of a broken or lost arch, take an impression in modeling compound which will show the tubes, and a new arch can be made very quickly, and by slight adjustments in the mouth can be fitted nicely.

#### RETENTION

My conception of orthodontia is that we are not only trying to restore teeth to what we have termed normal occlusion, but to restore the tissues and organs which constitute the oral cavity to normal function. From the time you start to treat a case of malocclusion with the lingual arch, until it is finished, it might be considered a continuous retainer, as it interferes so little with normal functions, and is constantly assisting in the development of these oral tissues in the direction of normal growth where nature has failed.

This paper is by no means a complete analysis of the removable lingual arch, but is only intended to show that tooth movement can be produced.

I have not touched on its use in connection with the labial arch, or by the use of the wire-stretching pliers, as this has been so ably presented by Doctor Lourie.