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ORIGINAL ARTICLES

THE LINGUAL ARCH IN COMBINATION WITH THE LABIAL ARCH WITH EXTENSIONS AS USED BY DR. LLOYD S. LOURIE

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ARCHES or alignment wires are known to the orthodontic profession either as labial or lingual arches. Orthodontists are familiar with the ordinary labial arch, also known as the expansion arch, which consists of a piece of metal threaded at both ends. However, the lingual arch was introduced later and is manufactured in various types. The lingual arch which I will attempt to describe in this paper as used by Dr. Lloyd S. Lourie, of Chicago, is worthy of special attention because of its compactness and esthetic value. This lingual arch has been evolved from the old retaining appliance, which consisted of bands upon the canines with a wire lingual to the incisors soldered to the canine bands.

This form of lingual retaining device was described by Angle in the sixth edition of his book on "Malocclusion of the Teeth." When this form of retaining device was used, rubber plates were employed for the retention of the molars and premolars. Some time before 1905 Lourie began using a lingual arch, the ends of which extended back to the bands on the molars. This lingual arch was made from a piece of wire which had been made to fit the lingual surfaces of the teeth, by soldering tubes on the distal end to slip over the screws of the ordinary molar clamp band on the "D" band as described by Angle. This was used for the retention of cases when it was found necessary to discontinue treatment during the summer vacation period.

It was found by using the wire stretchers and by making bends in the lingual arch that a certain amount of tooth movement could be accomplished without readjusting the ordinary expansion arch, which could be very easily adjusted because the clasp bands would still be in position with the buccal tubes. Lourie

used this form of the lingual arch as a retaining device for several years before he demonstrated it at a clinic at the Chicago meeting of the American Society of Orthodontists in 1905.

While using the lingual arch as a retaining appliance and being able to accomplish certain movements by using the wire stretchers and by bending the lingual arch, it appealed to him very much as a possible regulating device. He also found that such teeth as required rotation could be rotated as satisfactorily by using ligatures and bands in conjunction with the lingual arch as when the labial arch was used. By the use of either the labial or lingual arch alone with bands and ligatures, root movement can be controlled. He therefore began the use of the labial arch with the extensions which made possible root movement with the use of the bands, and consequently gave us a labial appliance which was less conspicuous than anything we have had heretofore. Owing to the fact that the labial arch has always been conspicuous, it is recommended in those cases where the lingual arch alone can be used because of its inconspicuousness and its esthetic advantages. This is sufficient to recommend its use in all possible cases. In fact, after seeing a number of Lourie's patients and examining a large number of models of cases which he has treated by using the lingual arch, I am of the opinion that the possibilities of the lingual arch with the small labial arch are limited only by the skill and ability of the operator. Another advantage of the lingual arch as compared with the ordinary expansion arch is that the appliance necessarily is shorter and can be made of smaller gauge without danger of displacement due to springing and bending. The shorter the distance between the point of the anchorage and the moving of the malposed tooth, the smaller the appliance can be in diameter. There is a limit to the small gauge and size of the labial arch especially if there is a great distance between the points of attachment. The small-gauged labial arch can be used if it is attached between the anchorage and the moving teeth. It must be remembered, however, that if there are many points of attachment and if those points are made rigid by the use of a large number of bands with some locking device, they necessarily interfere with the movement of the teeth by making a larger number of points of attachment which in turn will have some influence upon the anchor tooth, and also upon those teeth which are attached to the appliance. In using any style of the labial arch the greater the freedom of the movement or adjustment that you have upon the malposed tooth, the more satisfactory the appliance will be.

As stated before, there is a limit to the smallness of the gauge of the labial arch owing to the long span between the anchorage from the right to the left side, if the molar teeth are used as anchorage. If an attempt is made to move the incisors forward, the small-gauged labial arch, with attachments on the incisors and molars, will very often bend and spring towards the cheek and stand away from the teeth so as to cause an abrasion of the mucous membrane of the cheek. Of course this condition would not be allowed to exist very long with most operators, but I have seen it occur in a great many cases where the attempt was being made to use a small-gauged labial arch.

With a small-gauged lingual arch this bending is not apt to occur; in fact, it cannot occur because of the proximity between the lingual surfaces of the

incisors and the molars. It is possible to satisfactorily use material of a much smaller gauge for the lingual arch than for the labial arch for the same amount or type of tooth movement.

As stated before, the use of the lingual arch as employed by Lourie was evolved from the older retaining appliance which was first constructed by soldering tubes on the arch to fit the end of the screws on the molar clamp bands. The molar bands which carried buccal tubes were thus left in position and it was this buccal tube that was used with the labial arch with extensions. It was found by stretching and bending the lingual arch that a large amount of tooth movement could be accomplished and that rotation could be obtained in certain types by the use of the band and spurs.

The lingual arch in itself was not satisfactory when root movement was desired, but having the buccal tubes on the molar bands a labial wire could be used for that purpose. Such a wire is shown in Fig. 1, which is a labial arch of 17 gauge, gold and platinum, to which has been soldered four extensions projecting occlusally on the labial surface of the tooth too near the cutting edge and

Fig. 1.

thereby controlling the apical tooth movement. This labial arch when used with these extensions is adjusted so as not to come in contact with the gingivus. In fact, it is placed so far gingivally that it lays above the gingival margin of the tooth under the lip. The labial spur extensions stand away from the gum, as does the labial arch, so as not to interfere with the gingival tissue, and then touches the tooth at some point near the cutting edge. If a greater amount of the apical tooth movement is desired the spur touches the tooth near the cutting edge or may be bent over slightly to engage the incisal edge of the tooth. The labial arch is held in position either by the use of the intermaxillary rubber or by a ligature tied distal to the tube on the upper molar and in front of the intermaxillary hooks. When these labial arches are adjusted the patient is often advised that the appliance can be removed during the daytime and need be worn only at night; however, the majority of patients wear them continuously since no part of the appliance is visible except the small labial extensions. The shape of the labial arch can be maintained during the day by being placed on a form made out of modeling compound, upon which the arch is shown in Fig. 1.

As above stated, the lingual arch was first used by Lourie with a tube on the end to slip over the threaded portion of the molar clamp band. Later in his practice after the molar clamp band was discarded, a plain molar band was used in retention.

The combination of the lingual and labial arch eliminates the use of bands

on the anterior teeth. The main objection to the use of these bands is that they cause separation between the teeth so that after they are removed there is a lack of proximal contact, and during this period the tooth very often returns to its rotated position. By using a combination of the labial and lingual arches it is possible to retain rotation of the anterior teeth without destroying the proximal contact.

Formerly the mistake was made in attempting to separate the treatment period from the retention period. Retention is really a part of the treatment and very often a retaining appliance must be so constructed as to make it possible to adjust the teeth finely and delicately so as to get the proper proximal contact as well as the occlusal relations. Cases which have been shown as finished results were not really such because the model had been made immediately after the appliance had been removed and before the retaining appliances had been adjusted. A finished result is one which can be shown after the period of retention has been completed and sufficient time has elapsed to prove that the forces of occlusion are going to hold the teeth in their proper position. The great advantage of the labial and lingual arches in combination is that they allow all of the forces of occlusion to act properly. This adjusts each individual tooth with the possible exception of the two teeth carrying the anchor bands. The anchor teeth carrying the bands which hold the labial and lingual arches have not the same freedom of movement as the remainder of the teeth, and it very often happens in distoclusion and sometimes in neutroclusion that during the period of treatment the bands are removed from the first molars (at the time the retaining appliance is adjusted) to the first premolars. This allows the molars an opportunity to respond to the forces of occlusion which they have been prevented from doing because of the wearing of the molar bands during the period of treatment.

As already mentioned, Lourie first employed the lingual arch as a retaining device, then began using it as a regulating appliance, and at the present time has evolved the use of the plain lingual arch to a very high degree of efficiency. Owing to its delicacy and inconspicuousness, this lingual arch certainly has a great future in orthodontia and especially to those of us who have some consideration for esthetics and our patient's comfort. I would therefore recommend to those who are interested in the lingual arch to begin using it first as a retaining appliance, and after they have accomplished the majority of tooth movements by using it in that manner, they will be able to obtain a degree of efficiency in bending and stretching the wire that will enable them to use it as a regulating appliance.

Very little has been said regarding the attachment of the lingual arch to the bands. It must be remembered that the lingual arch can be divided into several forms, those where it is soldered to the bands and those that have some form of removable attachment; however, it is not intended here to go into the various forms of attachment as the writer hopes to be able to give the details of these attachments later on. This article was prepared more to call attention to the apparent inconspicuousness and the high degree of efficiency of this appliance when it is properly manipulated, than to go into details of construction.

Up to the present time Lourie has principally used a labial arch of gold and

platinum of 17 gauge, as shown in Fig. 1. The 17 gauge arch of gold and platinum is used because it has sufficient strength to hold the arch in its proper position. As stated before the labial arch lies above the gingivus and consequently must be of sufficient strength so that it will not be displaced during the period of tooth movement or by the action of the lips. It is possible that an iridio-platinum arch of a smaller gauge than 17 could be used. With the 17 gauge gold and platinum arch placed above the gingivus with the extension spurs as shown in Fig. 1, the appliance is very inconspicuous and in a great many instances the labial arch is removable by the patient; still very few patients remove them because there is so little annoyance or embarrassment caused by the appearance of the arch. When the bands are placed on the premolars, a labial arch of 19 gauge can be used because of the shorter distance between the premolar anchorage, and there is no danger of the arch being displaced because of the short span between the anchorage.

If intermaxillary anchorage is employed while the bands are fixed on the first molars, and after having shifted to the first premolars, spurs are attached to the first premolar for attaching the intermaxillary hook to the premolar band instead of to the labial arch, it is possible to have the hook farther occlusally. This hook attached to the band is less conspicuous than if it were attached to the labial arch, as the latter always lies above the gingivus. By having an intermaxillary hook attached occlusally to the premolar band it causes less of a downward pull and does not make as much of a leverage on the premolar as if it were attached to the labial arch.

In beginning the construction of this type of appliance the plain bands are first made upon the anchor teeth which we will presume are the first molars. Even in those cases where the lingual arch is to be used as a regulating appliance, buccal tubes are soldered on the molar band parallel with the line of occlusion for the possible use of the labial arch with the extension spurs. I have observed a number of Lourie's cases in which nothing but the lingual arch was used, but in the majority of instances, buccal tubes were adjusted on the molar bands so that it would be a very simple matter to fit a labial arch if its use should become necessary. As stated before, the attachment of the lingual arch to the molar band may be fixed or removable, each of which has some advantage. The lingual arch which is soldered to the molar band is necessarily more sensitive as the entire amount of force or adjustment falls upon some of the teeth. With a removable lingual arch there is always some play or lost motion in the point of attachment regardless of how accurately it may be fitted. On the other hand the removable arch possesses an advantage in the hands of those who have had little experience with the use of this device, because it is possible for a novice to remove the lingual arch and bend or shape it outside of the mouth. It must be remembered, however, that the removable type is not as effective in the hands of the experienced operators as the fixed type or that type of the lingual arch soldered directly to the molar band. There might be some objection to placing a buccal tube upon an anchor band for the possible use of the labial arch owing to the fact that some would make us believe that it would be annoying to the cheek. A small 17 gauge tube on the buccal surface of the molar band properly placed and fitted causes no annoyance to the patient. These buccal tubes always

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

make it possible to employ a labial arch for a short time to assist movement which the lingual arch is not producing. If the lingual arch does not accomplish the tooth movement desired, usually the fault lies with the operator and not the appliance, because I have seen the most difficult types of tooth movement accomplished with the lingual arch and if I had not seen the case before and after treatment I would have stated that such a movement could not be accomplished with the type of appliance used.

It has been stated before that the lingual arch is very delicate and inconspicuous and may appear to some practitioners as being incapable of producing as large a variety of tooth movements as has been accomplished. We all are aware of the fact that tooth movement can be accomplished by a very delicate force, but this force should be constant in direction, and nothing is more capable of producing a force in a constant direction than a small delicate lingual arch. It must also be remembered that any appliance moves a tooth either by pushing or pulling and it seems to make no difference as to the physiological activity whether it is a pulling or pushing force.

I might mention here a few requirements of the ideal regulating appliance. We have various appliances described in the literature as being ideal, but when we analyze them carefully from a mechanical and physiological standpoint they are very often lacking in some respect. The first requisite of a regulating appliance is that it shall exert force in such a manner as to be in accord with the physiological laws, but it must not interfere with the forces of occlusion any more than possible. The large amount of damage being attributed to the use of bands at the present time should cause orthodontists to stop and consider that bands of previous years which have been considered harmless may have caused a large amount of tissue changes which develop later in life. Consequently the tendency should be toward the elimination of bands. With the use of the lingual arch and the labial arch as described in this article only two bands are necessary. It seems certain that this appliance will more nearly approach the ideal condition than any appliance that has been used heretofore.

In using the lingual arch the force is exerted by two means, either by bending the lingual arch or by use of the wire stretchers. Wire stretchers were first employed in the practice of orthodontia by Angle. The type of instrument which he placed upon the market is shown in Fig. 2. They consist of round beaks with very strong handles. By placing the beaks over the wire and squeezing the handles together an indentation is made on the wire which increases its length. These wire stretchers should possess a screw as shown in Fig. 2 to control the distance to which the handles can be closed. Lourie has modified the wire stretchers by placing a small notch near the end of the beaks which assists in centering the wire stretchers upon the wire.

Because of the large size of the Angle wire stretchers and the difficulty of getting the beaks in the proper position in the use of the lingual arch, Lourie designed a smaller instrument as shown in Fig. 3. In bending the lingual arch, especially in the fixed type, it is necessary to have a pair of pliers with which it is possible to grasp the lingual arch at right angles to the direction in which we wish to apply the force. Fig. 4 illustrates what is known as the Bogue pliers which are very useful in bending the lingual arch. They are made in two sizes,

the larger size shown in Fig. 4 being the most satisfactory. Another very useful form of pliers is Lourie's modification of the How pliers (Fig. 5). While very convenient and a source of great satisfaction, it is not absolutely necessary that the operator possess Bogue pliers of this special modification of the How pliers. It is not my intention in this article to go into detail in regard to bend-

Fig. 6.

Fig. 7.

Fig. 8.

ing or stretching the wire, but simply to show the few instruments that are really necessary, and the simplicity of the whole plan in comparison to some of the other devices which are on the market that require many special instruments and a large number of especially made parts.

It is the simplicity of the combination of the labial and lingual arch both as a retaining and regulating appliance that appeals to me more than anything I

have seen for some time. In a personal communication Lourie stated that the combination of the lingual and labial arch was first employed in a case which was retained by the use of bands and spurs in which he experienced considerable trouble in keeping the teeth where they belonged, because the teeth relapsed on the removal of the bands before the closing of the proximal spaces and before the formation of the normal proximal contact. The occlusal view of this case is shown in Fig. 6. This is one of a type which is more or less difficult to retain and has probably been encountered by all who are engaged in the practice of orthodontia. The malocclusion is not extreme and the principal movement required is the expansion in the canine region with a rotation of all the incisors in the upper arch and practically all in the lower arch. The old plan of rotating these incisors by means of ligatures and spurs is partly responsible for the large number of failures experienced in this type of cases. Fig. 7 shows a study model made while the bands and spurs were used in retaining the upper and lower teeth. The position of these teeth as shown in the study model would in-

Fig. 9.

dicates that they had been moved to the proper position and show what would be called a finished result by a large number of men. However, the history of this case indicates that upon the removal of the bands (because of the lack of the proximal contact) the teeth drifted back toward the old positions. As a result of the difficulty encountered in this case by the use of bands, it was necessary to devise some plan which would eliminate the bands and allow the proximal contact of the teeth. Not only was it necessary to keep the expansion in the canine region but it was also necessary to prevent a torsion of the incisors during the process of retention. This meant there must be some means devised by which pressure could be made on the angles of the incisors to keep them in their proper position. Consequently the lingual arch was used and the labial arch with the spur extensions, as shown in Fig. 8. It will be seen that the bands are placed upon the first molars carrying small buccal tubes. Instead of being placed near the gingivus as in that case, at the present time the labial arch would be placed above the gingivus with the result that nothing would show upon the teeth except a small labial spur. The position of the lingual arch in this case, as shown in Fig. 9, differs materially from that used at the present time. In this case it will be seen that the lingual arch rests against the pre-

molars near the gingival margin, which plan has been found to be productive of more or less gingival irritation. Lourie states that food lodges in between the arch and the teeth with the result that severe inflammation occurs in the gingival region. Therefore at the present time the lingual arch is bent away from the gingival portion and rests against the lingual surface of the premolars.

This case is interesting and a matter of history because it shows as far as is known the first use of the combination of the labial and lingual arch with spur extensions on the labial arch to prevent rotation of the incisors and thereby overcome the difficulties encountered in the use of bands by many orthodontists. Even if it is possible to construct the band and not have it interfere with the proximal contact we would still have the unsightly appearance of the band upon the labial surface which is much more conspicuous than small spurs resting against the labial surface of the incisors. There would also be a greater tendency for decay owing to the loosening of the bands than from the small contact of a labial spur extension against the labial surface of the tooth which is very easy to keep clean owing to the small amount of tooth surface involved.

In the next installment of this article I will take up the use of the labial and lingual arch and the treatment of certain types of malocclusion and show the efficiency, conspicuousness and delicacy of the appliances as compared to some others.

THE RESULT OF UNPHYSIOLOGICAL PRESSURE EXPRESSED IN TWO CASES

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HISTORY OF CASE.

YOUNG lady, age 17. Open bite or infra-occlusion of the upper teeth as far back as the distal cusps of the six year molars. Arches lacking lateral development to the extent of about one-half inch. Class I mutilated, the lower left lateral having been extracted for the "straightening of teeth" at the age of ten. Upper incisors protruding, lower retruding.

ETIOLOGY.

Thumb-sucker at age of five. Habit broken by use of a solution of cayenne pepper and vinegar. Nasopharynx normal. Mouth-breather.

TREATMENT.

A description of the treatment in detail seems presumptuous as such was along the well known orthodox lines and in accordance with diagnosis. It might be mentioned that the Angle pin and tube appliance was employed on such teeth as demanded a definite root movement, and it is concerning the pin and tube in conjunction with vertical loops in arch wire, which were employed in case from Figs. 1 to 7, that I wish to emphasize.