The D. R. 11 - Light Resilient Arch For Use In Extensive Space Closure

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Not long ago, when only the misguided and indolent were extracting teeth preliminary to the correction of malocclusions, treatment called for a fairly uniform mechanism for all cases, and some of these seemed adequate to place the teeth in the desired position. It was not the mechanics that were responsible for failure in a large percentage of cases, but the orthodontists' misconception of the biologic factors.

When orthodontists finally realized that it was necessary to extract dental units and close extensive spaces in a large proportion of cases, it proved to be a very difficult procedure with these same mechanics. A new type of arch or bracket seemed to be indicated.

It is desired, in most cases where teeth are extracted, to hold the units distal to the space back and in an upright position, while the anterior units are retracted bodily in series. This became such a difficult thing to do correctly that additions were made to the current appliances to effect the desired positioning until the original appliance could hardly be recognized. Gadgets and accessories were created by the score, some attached to the arch, some to the bracket, and some to the bands. Each one was a temporary delight with an unhappy future. They protruded, jiggled, pinched, and made dental hygiene and the patient's happiness impossible. There were cleats, levers, springs, coils, loops, safety pins, and many other diabolical devices. After a gradual elimination of the excess mechanical paraphernalia, things seemed to level off and there evolved two warring camps (there are always two in any branch of science or politics): the vertical loop men, and the advocates of the coil spring. Neither would have anything to do with the other or with those weak-willed compromisers who used both.

Getting down to fundamentals, the basic requirements for any mechanical apparatus are simplicity and efficiency. The arch wire alone, bent to the form of a dental arch, is the simplest form. To be efficient, it must have additions and alterations in order to perform as required. This arch we apply to the edgewise bracket, which we will accept for lack of anything better thus far.

In extraction cases it is often required that we move the first tooth anterior to the space bodily to the distal, and later the other anterior teeth with the least amount of forward progress of the teeth posterior to the space. This is a challenge to our skill and ingenuity and there are few who can accomplish it successfully. I believe that it is generally accepted that our attack will be improved by tipping back the posterior teeth to enhance the stability of this anchorage unit. Next in importance is that the distal tipping of the tooth anterior to the space, whether it be a bicuspid or cuspid, should not proceed beyond the vertical position and root movement should precede crown movement from this point. This also applies to the incisors in turn. Occlusal interference should be reduced. Occipital, cervical or any form of additional anchorage should be utilized to assist in the movement of these teeth. Torque

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must be employed in the anchorage unit to keep these teeth from tipping buccally, but root or crown torque is undesirable for the tooth to be moved distally. Arch expansion or lateral movement of the teeth to be moved will interfere greatly with their distal progress and is to be avoided. Mass distal movement in Class III or Class II mechanics must be accomplished without torque in the incisal region and must be supplemented by extraoral anchorage. (The arch or arches selected must be able to fill these requirements.)

The arch should be able to perform as many functions as possible simultaneously without causing pain, so that arch changes and adjustments may be reduced to the minimum. The arch should be so resilient that major tooth movements can be obtained with one arch placement. It should be capable of long-range activation. It should embody the features necessary to carry out a logical and systematic series of steps in the treatment procedure. It should be small, inconspicuous as possible, smooth to the tissues, hygienic in design, but strong enough to do the work efficiently without breaking or bending under normal masticatory conditions.

The necessity of placing second order bends in the buccal bracket area creates a problem in that the arch will be shorter after the space is closed. This makes it necessary that the bracket of the cuspid move along the arch wire at least a part of the distance, regardless of what force is used. The arch then must allow some tolerance or clearance of the bracket-wall to permit this freedom of sliding movement and yet maintain root action. A pushing force against a bracket to effect distal movement requires a ligature tie to prevent rotation, which creates a bind on the arch and loss of force reaction. A pulling force against the surface adjacent to the space is more efficient,

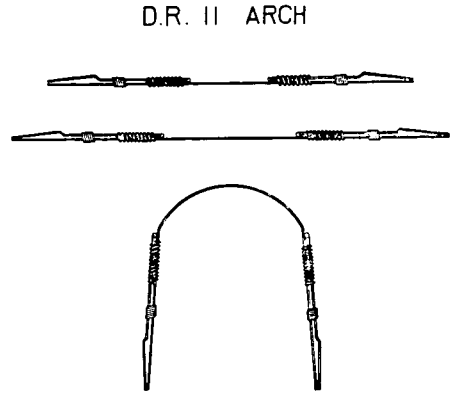

Fig. 1—D.R. 11 Arch.

as the only friction encountered is that of the arch in the bracket. The coil spring may be used either in pulling or pushing; it is fairly hygienic, inconspicuous non-protruding, and it has long-range light force action and force control in line with the arch wire on which it is located. Its principal disadvantage lies in the fact that it requires bracket movement along the arch, with the attendant friction and possible bind. The vertical loop can be adjusted so that this action takes place at the time of adjustment, so that the bracket and tooth are carried in the desired direction by the force of the loop closing. It is a more positive force, but carries with it more disadvantages. Its activation is far more painful to the patient for the same amount of tooth movement. It is probably the most unhygienic of all accessories and frequently moves out or into the tissues. The control of the units posterior to the loop is uncertain and difficult to manage, and it carries a limited range of action.

Rubber bands or grass-line ligatures are frequently used as accessories and they are effective; but the rubber bands require patient cooperation, the ligatures frequently become disengaged, and both are unhygienic when applied between attachments to teeth in the same dental arch.

In my quest for something I could use which had the requirements I demanded (and I could learn to put up with a few disadvantages), I hit upon the arch I call D.R. 11. (Fig. 1.) About ten years ago, I used Dr. Roy Dean's double arch section, using the two .011 x .025 arches edgewise. It was effective, but in my hands caused an undesirable tipping of the teeth toward the space. I gave this up, and then, for a number of years experimented with variations in the sliding twin section appliance as applied to extraction cases. In using the .011 x .022 arch wire in place of the twin .011 I enjoyed certain advantages, especially when it permitted placement of an additional arch wire in the bracket to form a split .022 square arch. This gives strength, torque, stability, resiliency, and ease of arch placement.

I had noticed that a light .015 spring-wire clasp on a plate would move a cuspid much faster than a heavier .030 wire clasp. The same thing should apply to arches, which then may be used so long as they have the strength to hold up and resist stress.

The arch I designed is a double laminated .011 x .022 ribbon arch, excepting in the incisal region where it is a single layer. Anterior to the cuspid is a stop formed by the outer wire and a 10 mm. section of open .010 high tensile coil spring. Distal to the cuspid is a 5 mm. segment of closed coil spring, and 10 mm. from each end is a stop-bend in the outer wire to increase stability of the arch in the molar tube and to prevent coil springs slipping off the ends while the arch is manipulated. (Fig. 2). These arches are prefabricated in two lengths; long, for second molar, and short for first molar arches. There are no solder joints. The arch is simply cut off to the desired length and contoured; second-order bends, torque and offsets are placed, and it is ready for work. The arch fits

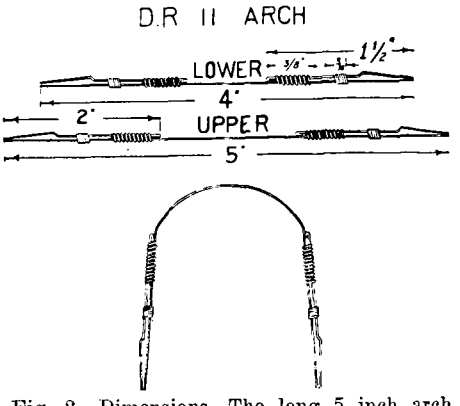

Fig. 2—Dimensions. The long 5 inch arch is used where second molars are banded in either lower or upper.

the brackets accurately with little or no leeway but may be often inserted at the outset, second-order bends and all, in place of preliminary limbering and leveling arches. It is strong enough to take care of all tooth movement up to the retraction of the four anteriors. This operation may be performed in the minor discrepancy cases. The thin double wire is so resilient that although there may be great variance of bracket alignment, the arch may be seated quite easily by a force exerted by the finger nails and yet it is so strong that the mesially tipped posterior teeth will gradually assume a vertical position and, in a few weeks, a distally tipped position ready to do the assigned work. It seems to be more effective for distal root movement of the cuspid than heavier wires used with vertical loops, and there is almost no lateral expansion force from the single .011 anterior wire. Placing a second .011 wire section over the inner arch wire in the incisor region will gain some torque when it is required, but the use of the heavy rectangular arch of .021 x .025 with long bulbous vertical loops distal to the laterals as the secondary arch is more positive and should be used for retraction of incisors where considerable root action is needed in this area in the final stages of treatment.

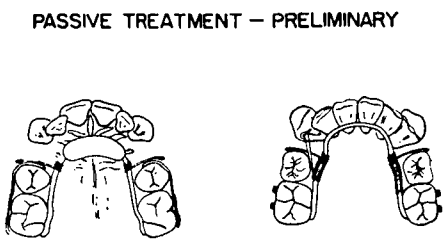

Fig. 3—Passive treatment. Preliminary.

In the routine practice this is a three-arch technique and all cases are completed with the .021 x .028 finishing arch.

The D.R. 11 arches are used in first bicuspid, second bicuspid, molar and incisor extraction cases and also in maxillary protraction non-extraction cases in the mixed and secondary dentitions in conjunction with extra-oral force.

Whenever possible, we remove the bicuspids as soon as they appear above the surface and immediately go into preliminary treatment, banding upper first and lower first molars and using a plate with cuspid and bicuspid clasps on the upper, and on the lower a Nance-type lingual arch with springs for cuspid retraction to vertical position. (Figs. 3 and 4).

At this point one should give a more detailed description of arch preparation in a typical first bicuspid extraction case starting the active treatment. (Fig. 5). In the upper arch bands are placed on the molars, bicuspids and cuspids; on the first molar buccal brackets if the second molars are to be banded, and a square lingual tube is soldered vertically to enhance stability. The upper second molars are rarely banded. An acrylic stabilizing plate is made with .025 clasps mesial to the bicuspids and light .011 x .022 cuspid clasps and a bite-ridge. After the cuspids have been moved to a vertical position by the clasps, an arch is selected, contoured roughly for arch form and curve of Spee and placed in the molar tubes. We now convert this arch to two buccal side sections. Cut the arch 10 mm. in front of each cuspid, then cut 3 mm. off the inner wire and bend the outer wire over it so that a smooth round surface is formed. This is welded or soldered together. The arch sections are then tied in to the brackets with the open push coil mesial to the cuspid and the closed pull coil distal to the cuspid bracket and tied to its distal eyelet. The arch ends are bent lingually distal to molar tubes to compress the open spring, and the distal end of the pull coil is tied back to the bicuspid bracket which is also tied to the molar.

The lower arch is treated in a similar manner excepting that we use the complete arch instead of sections. (Fig. 6). It is placed in molar tubes, adjusted

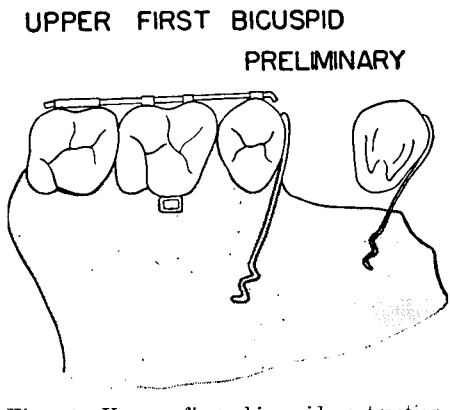

Fig. 4—Upper first bicuspid extraction. Preliminary.

to position, and the first cut is made for length distal to the left molar tube, just enough to separate the wires so that the inner wire will slide clear back until it is in contact with the anterior teeth. It is then cut distal to the molar tube. The outer arch is then pushed back through the molar tube until the coil spring is compressed against the cuspid bracket. It is then cut off distal to the tube. On the right side, the free end of the wire is bent buccally until the coil spring is compressed against the cuspid bracket. It is cut off 4 mm. from the bend. The arch is removed,

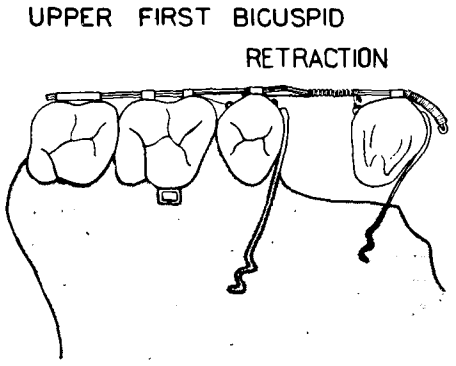

Fig. 5—Upper first bicuspid. Retraction.

annealed at the point of the last cut, and then bent back on itself toward the inner wire 2 mm. to serve as a stop for cuspid coil spring. The separated left arch ends are welded or soldered together. Now with ribbon-arch bending pliers, using the .022 slot to hold arch wires, place second-order bands and torque in molar and bicuspid areas, offset bends for molar and cuspid and sharp gingival bend mesial to bicuspid for root movement. Place the arch and tie in. Bend the ends lingually until cuspid coil springs are compressed and anterior wire contacts the teeth. The closed or pull coil is lying free between cuspid and bicuspid. Tie from distal eyelet of cuspid to the mesial of coil and then tie from distal end of coil back to bicuspid bracket. This frees the bind of the rotating cuspid as its action rectifies any rotation tendency as it pulls from the distal. As the cuspid proceeds distally and the space closes, segments are cut from the mesial of the closed coil and pushed mesial to the cuspid to activate the push coil. As the space is closed distal to cuspid it should open mesial to the cuspid. The upper closure precedes the lower and, after the upper is complete, continuous Class III anchorage is used, supported by extra-oral anchorage at night. When the lower posteriors are well tipped distally, the lower anteriors are banded and aligned and tied together, but not retracted. After cuspid retraction is complete and the spaces are now distal to the laterals we place the secondary arch, the .021 x .025, with long bulbous loops, mesial to the cuspids. This arch is contoured and tip-back bends are placed in the bracket areas. It is seated in the buccal brackets and tied in with the anterior arch section lying gingival to the anterior brackets. The annealed ends are pulled back and bent lingually to hold it. Then the anterior free arch is grasped with two wire ligatures distal to the lateral incisor brackets, sprung forward, and slipped into the brackets. The same procedure is followed for each adjustment of which there will be approximately three. Class III anchorage is continued until all spaces are closed. This arch is removed and a previously formed .021 x .028 stabilizing and finishing arch is placed. We are now ready for the maxillary retraction and a new full D.R. 11 arch is used in place of the upper retraction sections and plate. (Fig. 7). Contour and a generous curve of Spee are placed in it, coil springs, and stops anterior to cuspids serving as intermaxillary hooks, while the archwire is kept free of the anterior teeth, by pushing segments of the reserve closed coil mesial to the cuspid bracket. Class II anchorage in the daytime and cervical at night is used until normal inter-digitation of posterior cusps occurs. Generous space should now appear on either side distal to the lateral incisors. The upper anteriors are banded, aligned, and the case is ready for a .025 x .021 secondary bulbous loop arch which is applied in the same manner as in the lower. Class II rubbers are continued. After space closure and lingual root movement of centrals and laterals, the finishing arch of .021 x .028 is placed for two months.

The second bicuspid extraction cases are handled in a similar manner, but

LOWER FIRST BICUSPID — EXTRACTION

EXTENSION COIL

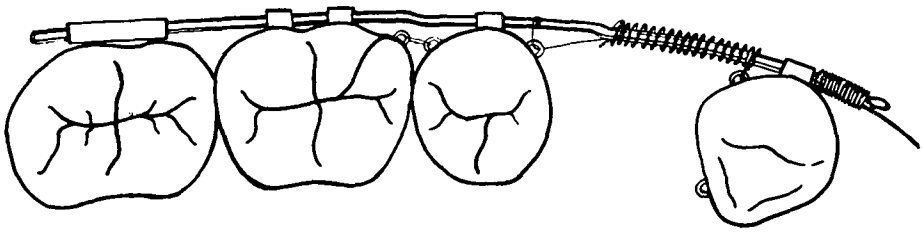

Fig. 6—Lower first bicuspid retraction

the first bicuspid must be completely retracted before starting on the cuspid. (Fig. 8). The placement of the cuspid band is omitted during bicuspid retraction to accomodate a longer push coil spring and the anterior teeth are banded instead. The pull coil distal to the bicuspid is shortened as the space closes and the segments are pushed forward mesial to the barcket. In the upper arch the distal action on the bicuspid is assisted by the force of a light .011 x .022 wire clasp from the stabilizing plate directed against the mesio lingual surface of this tooth. After complete closure, the eyelets of molar and bicuspid are tied together, the cuspid is banded and retracted as previously described. This procedure is followed with the secondary arches if

DR II MAXILLARY ARCH — AFTER SPACE CLOSURE

CLASS II MECHANICS

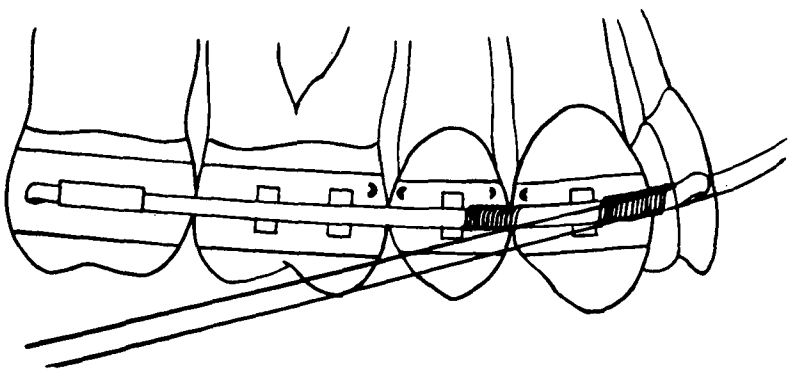

Fig. 7—D.R. 11 applied to maxillary arch after space closure. Class II mechanics.

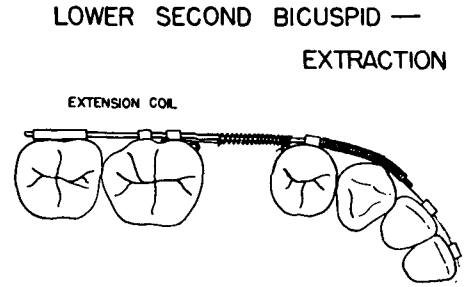

Fig. 8—Lower second bicuspid extraction. Compression and extension coils.

lingual root movement of anteriors is desired, and finally the finishing arch is placed. These cases require approximately four months longer in treatment than first bicuspid extractions but are quite gratifying in the fine appearance of the upper arch with its stronger and more anatomic first bicuspid in place.

It is frequently desirable to place a stop on the arch, either for a molar tie-back or a spur or coil spring stop. (Fig. 9). This may be done by slightly annealing the outer arch before placement. A right-angle explorer is inserted between the arches and a special grooved plier is used so that the beaks compress the annealed arch over the explorer insert. These stops may be placed or erased in the mouth and offer the appliance a distinct advantage when this becomes a necessary operation for a particular strategy in treatment. The versitility of this mechanism with these stops is apparent to the operator after a brief experience with it so that complicated cases with unilateral requirements may be strategically handled with excellent control. (Fig. 10 A and B).

The case is now ready for retention. Bands are removed from all teeth excepting the last molars banded. This usually means the lower second and upper first molars. The finishing arches are replaced and the anteriors ligated to the arches with one ligature. The arches are tied back and the case allowed to settle for one or two weeks. The cervical or occipital gear is applied to the upper arch during this process. All bands are removed and impressions taken. If cuspal incline plane relation, arch form and axial tooth position are favorable, retainers are constructed. If one of these factors needs attention, the case is prepared for construction of a positioner which is worn for several months. Then new impressions are taken for retainers. Impressions may be taken for the positioner with molar bands on before space closure and posi-

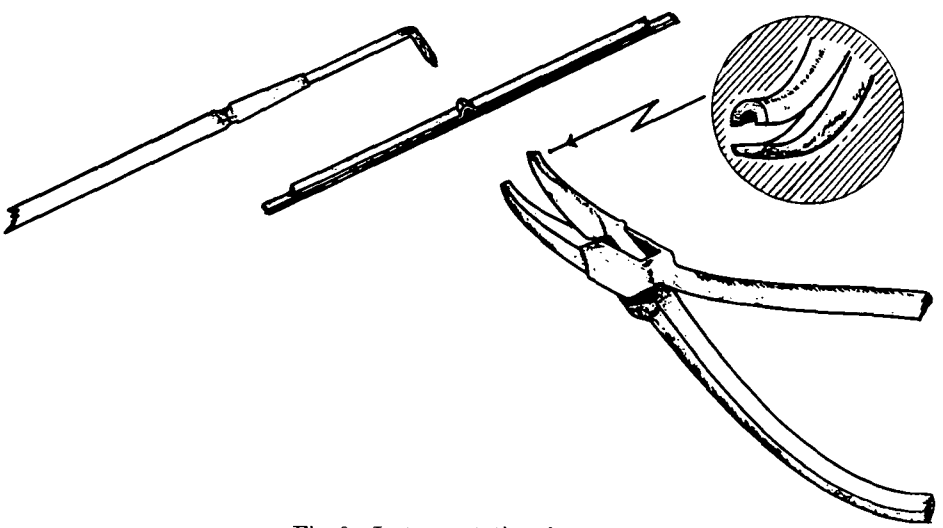

Fig 9—Instrumentation for stops.

FIRST MOLAR EXTRACTION

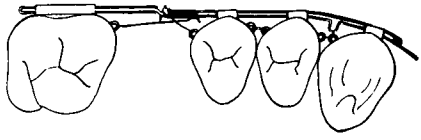

Fig. 10A—The use of stops on the outer wire.

LOWER CENTRAL EXTRACTION

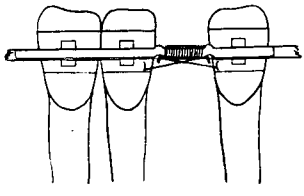

Fig. 10B—The use of stops on the outer wire.

tioner placed the day of final band removal.

The retainers are worn at night only. This seems adequate and certainly reduces the hazard of loss and breakage. The lower is made without clasps and fits in the usual manner the necks of the teeth and the bearing area of lingual tissues supported by bone. The acrylic passes over the incisal edges of the lower laterals and centrals and 3 mm. over onto the labial surfaces. (Fig. 11).

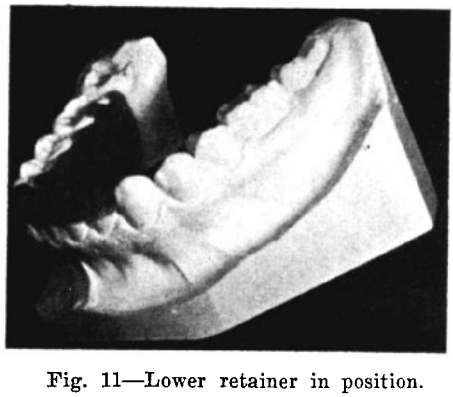

Fig. 11—Lower retainer in position.

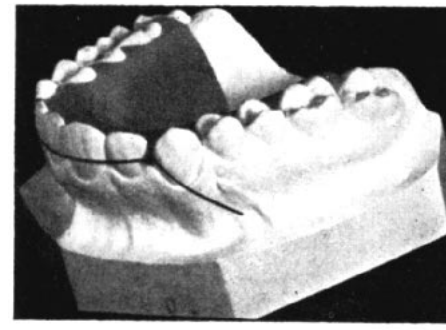

Fig. 12—Upper retainer. First step.

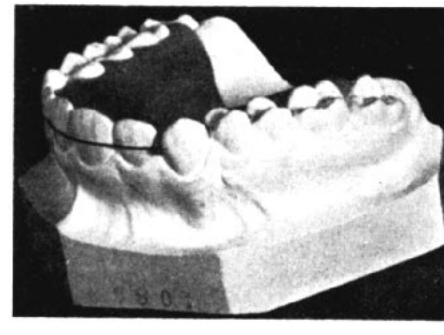

Fig. 13—Upper retainer completed.

This lower bite ridge contacts evenly a flat low ridge on the upper plate, the bite opening in the anterior region amounting to approximately 3 mm., which is according to cephalometric studies made by Wylie, the average rest position of the mandible. The wires in the upper of .025 pass over the embrasure between lateral and cuspid and end in a small closed loop directed

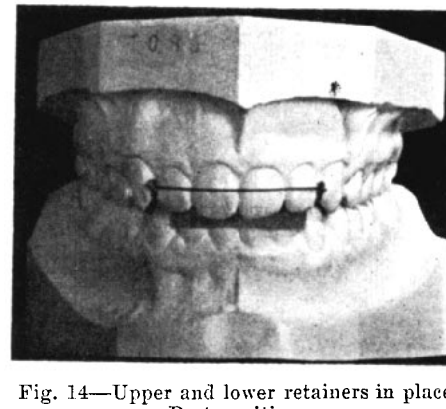

Fig. 14—Upper and lower retainers in place. Rest position.

toward the gingival embrasure. An .015 round wire annealed on its end is threaded through the upper left loop and the short end pulled around mesially and threaded through the loop again, then around to the mesial where it is cut off close. The retainer is then placed in the mouth and the long end of the wire is placed through the right-hand loop and pulled tight and forward. (Fig. 12). The retainer is removed and the .015 wire is annealed at the point of this bend. The .015 wire is then pulled around to mesial, threaded through the loop, pulled tight and around to mesial where it is cut off close. (Figs. 13 and 14).

This type of retainer is free from tension and metal strain by having a center floating wire, and yet the coils at either end hold it rigidly horizontal. It may be loosened or tightened by grasping the coil with ribbon-arch pliers and turning to distal to loosen and to mesial to tighten. In this way minor anterior rotations are corrected on the plaster model by cutting off these teeth and replacing them in plaster. The light resilient wire will work effectively to correct these deviations.

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