A Technique for Indirect Archwire Construction

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Various techniques have been submitted for the construction of indirect archwires,[1,2] but most of the techniques had major defects and were generally discarded by orthodontists. However, in 1963 Boone described a technique of indirect archwire construction that was an advancement over previous methods.[3] The underlying principle of his technique relied upon measuring the chords of individualized arcs in order to obtain circumferential linear dimensions.

This technique is quite accurate for the various measurements made in the anterior sections of the archwires, but the accuracy varies inversely with the distance from the midline. This occurs because the severe arc of the dental arch form exists only from cuspid to cuspid. From the cuspid distally, the archwire is more akin to a straight line. This explains why tie-back loops will often vary as much as four millimeters when completed by Boone's technique.

The indirect archwire construction technique described here is an attempt to improve the accuracy of all intraoral measurements and, in particular, those measurements in the distal portions of the dental arch.

ARMAMENTARIUM

A symmetry chart with two arbitrary arches is used in this technique because a single arch, as suggested by Boone, has been found to be inadequate for the very narrow arches. The addition of the smaller arch to the symmetry chart allows an anterior arc that is more compatible with narrow arches (Fig. 1). Experience has shown that most patient arches will fall within range of the two arbitrary arches shown on the symmetry chart or, in other words, the cuspid and molar widths of most dental arches will fall within the range of the two selected arbitrary arches.

The millimeter markings were added to the arbitrary symmetry arches since the essence of this technique relies upon direct arch measurements with an adapted plastic millimeter gauge. Once the measurements are made intraorally, they can be easily and accurately transferred to the selected symmetry chart.

A Boley gauge that has been radically modified with a large laboratory carborundum wheel is used to measure the widths between the first molar tubes and between the cuspid brackets intraorally. The Boley gauge is also used to measure the individual anterior teeth.

A wax pencil is needed to mark the measurements from the symmetry charts to the archwires.

Any small, clear, plastic millimeter ruler can be adapted for intraoral use.

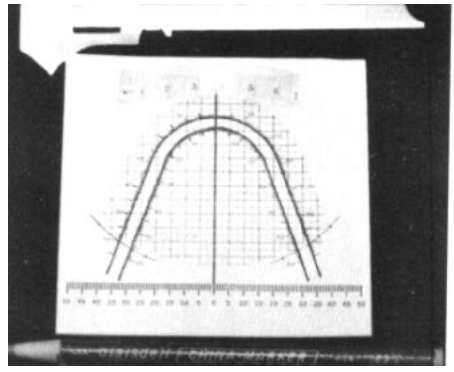

Fig. 1

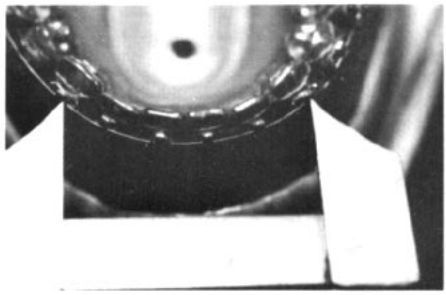

Fig. 2

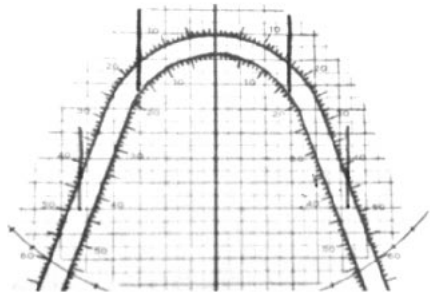

Fig. 3

Usually the width of purchased rulers must be halved, and the length shortened to about seventy millimeters. A curve is established in the plastic ruler by inserting the modified ruler in a plaster mold and heating it several minutes in hot water.

The plaster mold is easily made by adapting a single strip of base plate wax ten mm wide in the shape and size of the smaller arbitrary symmetry arch. This wax pattern is imbedded in plaster and later displaced by boiling water.

A straight millimeter gauge is located at the bottom of the symmetry chart to assist in the fabrication of multilooped archwires. The author feels it is easier and more accurate to bend these loops in a piece of straight wire and then form the arc than vice versa.

Technique of Measurements

The first measurements are made only after the banding of teeth is completed and a flexible, initial archwire is tied in the brackets. The Boley gauge is then used to determine the width of the mandibular cuspids and molars at the brackets and tubes, respectively (Fig. 2). These measurements determine which of the two arbitrary arches will be used for the patient. The more narrow arches will be more easily accommodated by the inner arch, while wider arches will find the outer arch more accurate.

These lateral width lines are made parallel and equidistant from the midline and represent the lateral dimensions of the mandibular archwire. Pencil marks are made on the symmetry chart to indicate these widths (Fig. 3).

Once the lateral widths of the cuspids and molars are determined, measurements of the individual mandibular incisors and cuspids are made as accurately as possible with the Boley gauge. The widths of the mandibular central, lateral and one-half of the cuspid are transferred to the selected symmetry arch and bilateral marks are made at the junctures which the middle of the cuspid brackets make with the cuspid lateral width lines. When the mandibular anterior teeth are not irregular, the chord of the anterior arc can be measured directly with the Boley gauge, and the juncture marks made without measuring the widths of the individual teeth (Fig. 4).

The curved plastic millimeter gauge

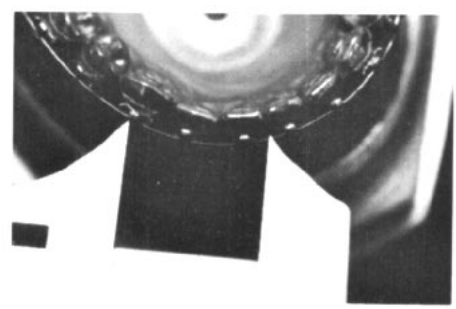

Fig. 4

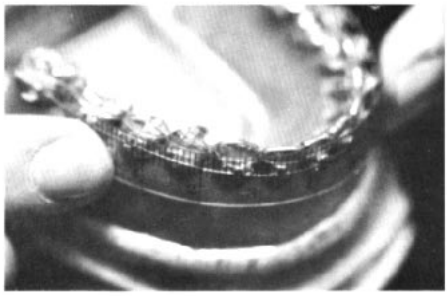

Fig. 5

is then used to measure from the mandibular midline to the mesial of the first molar tube (Fig. 5). Bilateral pencil marks are made across the intersections which these measurements make with the molar lateral width lines. Although bilateral measurements will often vary at the molar tubes, the molar measurement deemed more representative should be used on both sides for the sake of symmetry.

There are now two points on each side of the arch through which the archwire should pass in order to conform to the patient's basic arch form. Additional juncture marks can be determined for bicuspids and second molars, but the two suggested junctures are usually adequate (Fig. 6).

Measurements are now made to determine the positions for first order bends, loops, tie-backs, and/or any soldered accessories that might be used.

These measurements are made intraorally with the plastic ruler and are made from the midline bilaterally. When possible, the measurements should be adjusted so that they are equidistant from the midline.

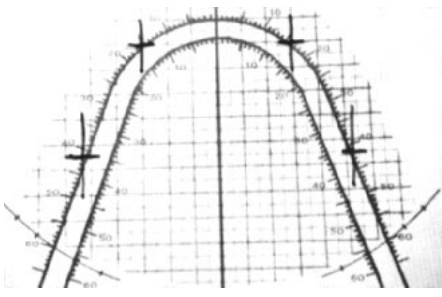

Fig. 6

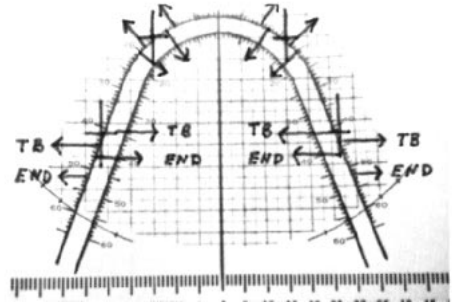

Fig. 7

The mandibular first order bends are indicated by arrows drawn on the inside of the symmetry arch. Boone recommends the use of identification numbers for these bends, but the author's experience indicates that simple arrows drawn at the point where the bend is to be made is enough explanation. If a tie-back loop is to be placed, a "TB" can be added at that arrow. The ends of the arch can also be marked with an "E" at the end of those particular arrows.

All of the maxillary first order bends are indicated by arrows drawn on the outside of the symmetry arch (Fig. 7).

Technique for Archwire Construction

The amount of torque to be used in the maxillary and mandibular areas is determined from the original diagnosis and treatment plan, the most recent cephalometric tracing, and clinical observation. The amount decided upon is placed in a piece of straight wire stock with a special turret.

The mandibular arch blank is then superimposed on the symmetry arch and marks are made with a wax pencil at the various points for first and second order bends. These bends are

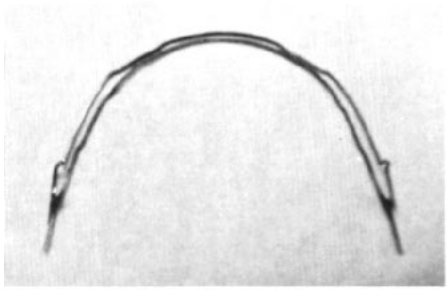

Fig. 8

made from the midline distally. Right and left bends for the same point are made in succession because of the ease of duplication when they are done in pairs. After the first and second order bends are completed, third order bends that establish the desired torque in the various areas of the archwire are made. Adjustments for the curve of spee can also be completed at this time.

The wire is now individualized by adjusting it to pass through the cuspid and molar junctures. The mandibular archwire should now have the correct anterior torque, arch form, lateral width, peripheral arch lengths, and symmetry.

The procedure for developing the maxillary archwire is similar to that used with the mandibular arch.

When the maxillary archwire is completed, it should be coordinated with the previously finished mandibular wire. The amount of coordination between the two arches is perhaps arbitrary, but a reasonable technique is to have the maxillary central incisor area one arch width away from the mandibular incisor area; the maxillary lateral insets should closely approximate the mandibular cuspid offsets; the maxillary cuspid and bicuspid areas should be one or two arch widths outside of and parallel to one another (Fig. 8). It will often be necessary to place exaggerated "tow-in" bends at the maxillary molars to keep them correctly rotated. When this is done, the maxillary molar areas of the wire will cross the mandibular arch. In these instances a posterior crossbite is probably prevented by the antirotational force of the maxillary molar tieback.

Obviously, the final archwire adjustments made at the chair with the patient present are important. Once these final adjustments are completed, the archwires are heat treated, polished, and then placed in the mouth.

Summary

A technique for the construction of indirect archwires has been described. The techniques needed to develop the necessary armamentarium have been discussed. The use of this technique will allow the development of accurate, individualized archwires that can be produced by the orthodontist or auxiliary personnel without the patient being present.

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