The Ribbon Arch

Its Influence in the Development of Orthodontic Appliances

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A description of the clinical application of the landmark Ribbon Arch appliance by an orthodontist whose first clinical experience was with that appliance, before the Edgewise mechanism was presented to the specialty.

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The Edgewise mechanism has dominated the orthodontic scene for so long that it is not generally realized that its fundamental principles were drawn from an eminently worthy predecessor.[1] That predecessor, the Ribbon Arch appliance (Fig. 1), marked a real turning point in orthodontics. This was the first orthodontic appliance with the capacity for full three-axis control of tooth movement. It was the basis on which Angle developed the Edgewise appliance; in fact, he originally developed the Edgewise bracket as an adjunct for the Ribbon Arch appliance, not as a substitute for it.[2] Later on, it provided the mechanical basis for Atkinson's Universal and Begg's Lightwire appliances as well.

It is unfortunate that so little was published during the 1920's when the Ribbon Arch saw its greatest application. As a result, its effectiveness has gone almost unnoticed and today's textbooks are able to provide better illustrations of the somewhat primitive nineteenth-century orthodontic appliances than of the much more advanced Ribbon arch.

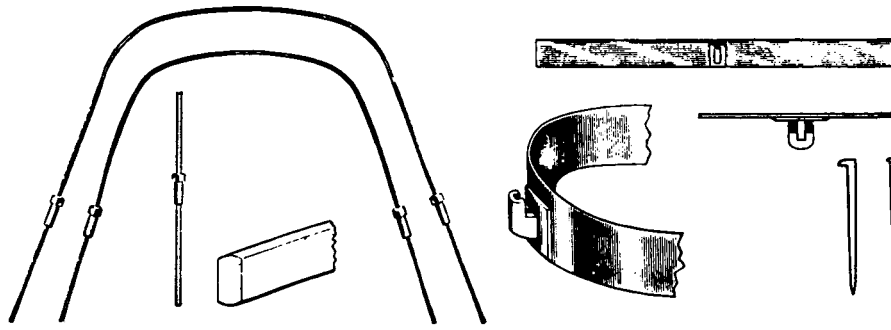

Fig. 1 The basic elements of the ribbon arch appliance. The arch wires illustrate the threaded arch ends and the friction sleeve nuts that were partly inserted in the larger round ends of the curvilinear tubes to prevent the nuts from loosening after being tightened. Enlargements of the brackets show the openings for the lockpins that held the ribbon arch securely in place in the brackets.

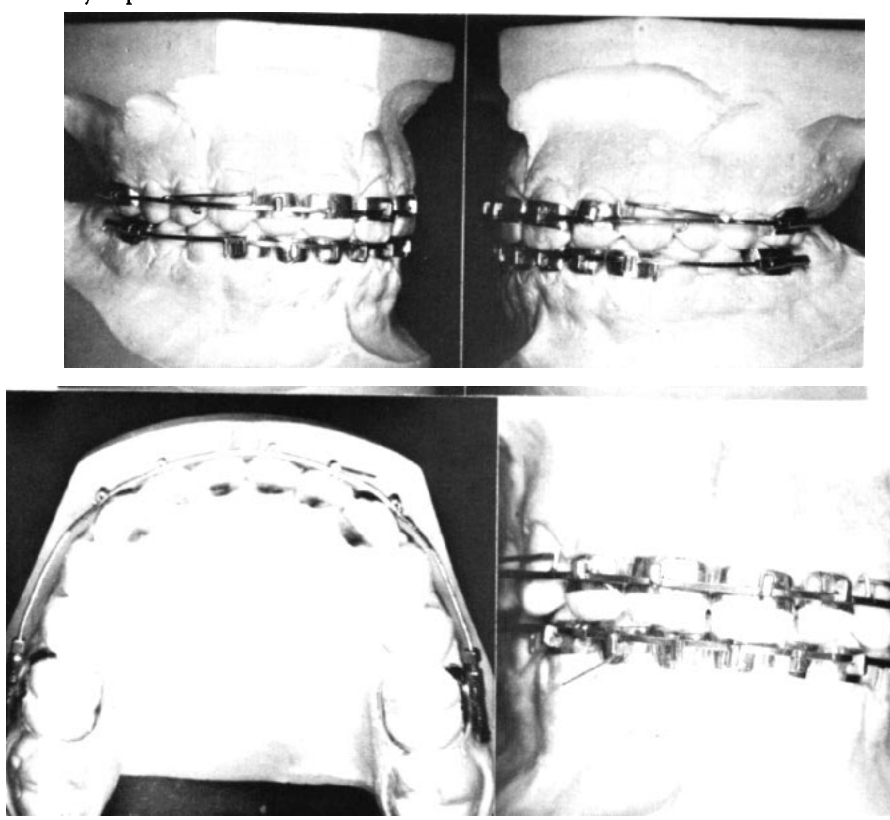

Fig. 2 A typical assembly of the ribbon arch on the plaster casts of a treated Class II malocclusion. The upper arch wire carries Class II elastic hooks and auxiliary springs to move the upper posterior teeth distally. The upper molars were moved distally by tightening the locknuts. Extraoral traction was placed when indicated. Elastics to vertical hooks in the cuspid areas were used to close an open bite. The lower right lateral incisor bracket shows the insertion of an uncut lockpin. The lower locknuts have been loosened to permit arch consolidation prior to removing appliances.

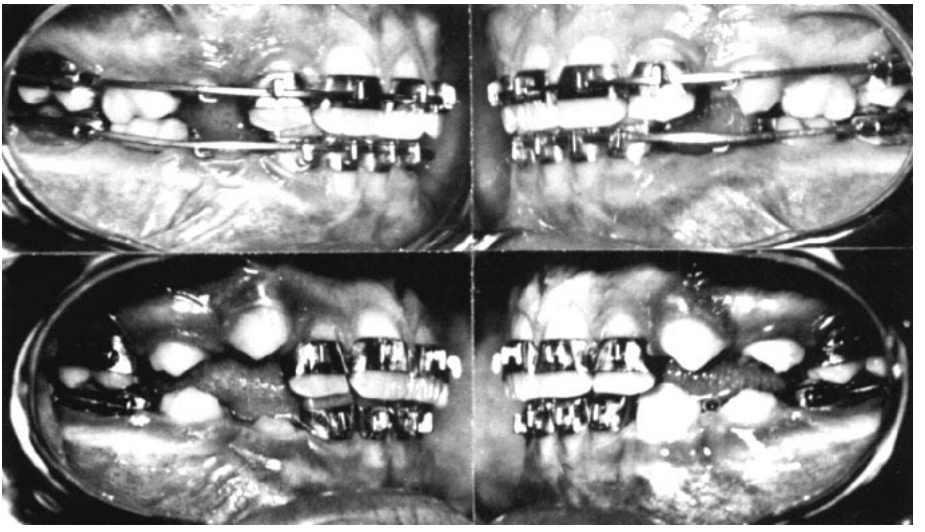

Fig. 3 This ribbon arch appliance is from an early serial extraction case, the first radiographic records for which date from 1938. The flat side of the ribbon arch is inserted into the incisor brackets. The threaded ends of the arch wire can slip farther into the molar tubes when activated by space-closing rubber elastics extending from arch wire hooks to the distal ends of the molar tubes. The locknuts prevent the wire from slipping too far into the tubes. The locknuts can also be tightened to increase the space when indicated. Small spurs soldered distally to the lateral incisor brackets prevent these teeth from sliding distally along the arch wire. The upper photographs were taken just before the extraction of the first bicuspids and the subsequent natural loss of the second deciduous molars. The lower photographs illustrate normal eruptive patterns for the cuspids and second bicuspids at the end of the active treatment period.

As with the Edgewise mechanism, the Ribbon Arch appliance provided rectangular bracket slots for the engagement of rectangular arch wires, and bracket position was just as critical with the one as with the other.[3] Round wires could be used with either appliance, but it was the rectangular arch wires that provided a precise means for the bodily movement of teeth when inserted into the rectangular brackets. These distinctive features made both appliances much more effective than any of their predecessors in the treatment of malocclusion.

The principal physical difference was that the slot of the Ribbon arch bracket opened vertically, with the greatest dimension in that direction, while the Edgewise bracket opens horizontally with the greatest dimension in that edgewise orientation (Fig. 2). The vertical Ribbon bracket made it possible to tip anterior teeth labially or lingually. The horizontal Edgewise bracket added direct archwire control over the mesial and distal inclinations of teeth as well.

Vertical Brackets vs. Horizontal Tubes

Of equal importance is the greater ease with which rectangular arch wires can be placed into horizontal edgewise tubes and brackets on the posterior teeth. It was much more difficult to insert a ribbon arch wire in a horizontal molar tube right next to a vertically slotted bicuspid bracket (Fig. 3).

Despite its limitations, the Ribbon arch appliance was capable of achieving rather remarkable results in difficult as well as in carefully selected cases.[4] It was a major advancement when first presented in 1916 by Edward H. Angle, and it continued to be a principal orthodontic appliance until he published his "Latest and Best" Edgewise article eleven years later.

When compared to previous appliances, the Ribbon arch could be considered a light-wire appliance, even though its widest cross section was .036 inch (0.9 mm) (Fig. 4). As with the Edgewise appliance, a light round arch wire was usually placed first to initiate the alignment of irregular teeth.[5] The rectangular Ribbon arch was designed to fit accurately into matching .022 × .036 inch (.55 × .9 mm) rectangular brackets. It was held in place by a lockpin in each bracket, with the arch ends inserted in horizontal molar tubes.

A unique feature of the Ribbon arch wires was their threaded ends, which were fitted with friction sleeve nuts that could be tightened to increase the space between the molars and the anterior teeth.[6] The Ribbon arch tubes were enlarged at the mesial end to receive the round friction sleeve portion of the nut, which was usually referred to as a locknut (Fig. 1). The molar tubes were called curvilinear sheaths, since they were slightly curved to lie close to the convex molar band surface. The smaller distal ends of the curvilinear sheaths had the same rectangular internal dimensions as the archwires.[7]

The eight incisors and lower cuspids were almost always fitted with Ribbon arch brackets. Spurs were soldered on the arch wire distal to each lateral incisor or cuspid bracket to prevent the anterior teeth from sliding distally along the wire as it was advanced by the adjusting friction sleeve nuts.

Auxiliary Attachments for Appliance Efficiency

Auxiliary finger springs were soldered to the wire to move the cuspids distally when indicated. Bicuspids were often ligated to the arch wire with a cervical wire to increase arch width. Lower bicuspid eruption could be induced by tightening a ligature wire completely around the tooth under the cingulum and then tying it to the arch wire (Fig. 4). It was in the bicuspid area that the Ribbon arch appliance was considered somewhat inefficient, for it lacked full control over these posterior teeth.

The Ribbon Arch performed well with cervical traction in moving upper incisors lingually and upper molars distally. This could also be accomplished with light Class II elastics extending from the lower molar tubes to hooks soldered on the upper arch wire in the cuspid area—provided that the lower arch was normal and well-developed in every way. Excessive force could move the teeth too far off the supporting alveolar ridge, just as will happen with any appliance when too much force is applied.

The Ribbon arch found its greatest application in uncomplicated Class I and Class II malocclusions. It could quickly realign crowded and rotated incisors in normally-developed arches, and it could open up spaces for cuspids and bicuspids that needed a little more room in otherwise well-developed arches. But the Edgewise appliance was much more effective in correcting closed bites since it had direct control over the bicuspids for the correction of an excessive curve of Spee.

In first bicuspid extraction cases, the Ribbon arch could close the re-

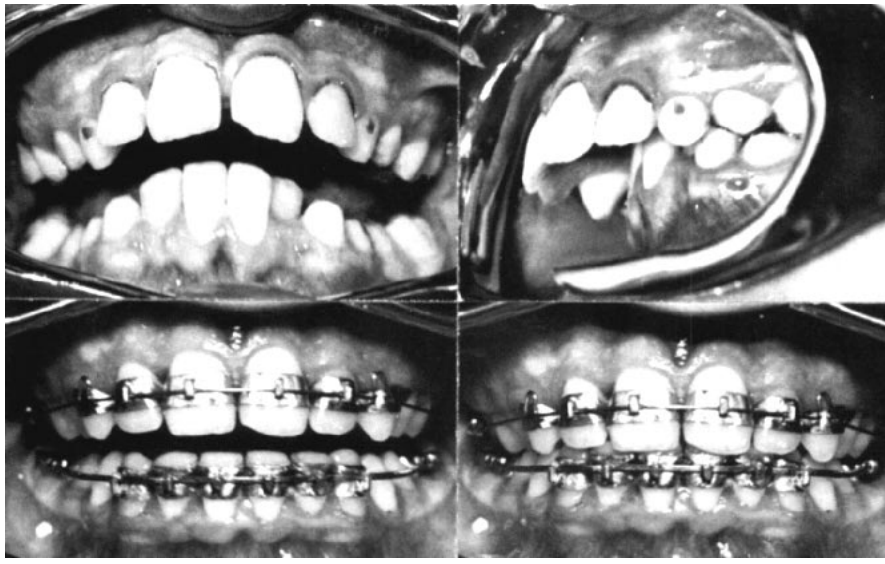

Fig. 4 This case illustrates the ability of the ribbon arch to correct rather extensive Class II malocclusions. The use of a plain round upper arch wire permitted the labially-inclined upper incisors to rotate lingually without torqueing and detorqueing a rectangular ribbon arch wire. The upper contoured loops serve as anterior attachments for cervical traction and Class II elastics. The lower rectangular ribbon arch provided a certain degree of "stationary" anchorage. Note improvement in curve of Spee and in gingival tissues on the labial surfaces of the lower central incisors.

maining spaces but it was not very efficient in uprighting badly tipped teeth on either side of extraction sites. It was, however, as effective as the Edgewise appliance in inducing normal labiolingual inclinations of upper and lower incisors (Fig. 4).

Elastics, Torque, and Extraoral Traction

Moderate Class II cases with good mandibles also responded well to Ribbon arch treatment, often with Class II elastics alone, but even more effectively when cervical traction was used in early mixed dentition cases. Labially-inclined upper incisors readily tip lingually as the upper posterior teeth move distally. If extraoral traction was required, the inner arch of the face bow was inserted into double tubes attached to the upper molar bands.

The Ribbon arch, with its greatest flexibility in the horizontal plane, was actually superior to the Edgewise appliance for the rotation of individual teeth. All the orthodontist had to do to augment the rotating effect was to offset the Ribbon arch bracket slightly to the mesial or distal, depending on which way the tooth was to be rotated. Wire leverage would quickly rotate the tooth to its normal position.

In contrast, the Edgewise bracket had to be placed in an opposite off-center position and the arch wire then ligated repeatedly to a staple soldered on one side of the band. It was not very effective, and I recall soldering pieces of molar band material to the sides of centrally-placed edgewise brackets to act as rotating levers. When steel Edgewise appliances became popular, brackets could be obtained with levers already attached.

Even this advancement lacked the convenience and compactness of an archwire lying directly against the band as it did with the Ribbon arch appliance.

The original Ribbon arch appliances were fabricated in gold-platinum alloys. Later, the bands and archwires became available in a nickel-silver alloy that included copper, zinc, and nickel. This metal soon turned black on the teeth.

The Ribbon arch did not disappear completely with the arrival of the Edgewise appliance. Similar ribbon arch brackets were incorporated into the Universal appliance and later into the Begg multiple-loop light-wire technique. Like all modern attachments, these devices have long since been available in stainless steel.

Summary

Orthodontists learned the principles of torque control with the Ribbon arch appliance. Such adjustments were almost always indicated in the anterior region to prevent the rectangular arches from displacing the incisor roots too far to the labial. The effects of torque force are even more extensive with an Edgewise appliance in which all of the teeth are bracketed, but it was the Ribbon Arch that showed the way.

The Ribbon arch served orthodontics well in the decade between its publication in 1916 and the introduction of the Edgewise appliance in 1927. Orthodontists learned valuable lessons about precise bracket position, torque, light wire application, rectangular wires, rotation techniques, and especially about the mechanical limitations in treatment procedures. The Ribbon arch had provided a sound foundation for the appliances of today.

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