Integrative Orthodontics with the Ribbon Arch

By
Larry W. White, D.D.S., M.S.D.

Abstract

The ribbon arch previously had great popularity and utility early in the 20th century, but lost its appeal as edgewise techniques developed. Some clinicians have made attempts to revive the procedure, but they have relied upon costly changes in bracket and band inventories and have not yet received extensive endorsement. A newer approach that relies only upon the use of newly developed titanium and stainless steel ribbon arch wires offers orthodontists a simplified and inexpensive method for assimilating this helpful method. Such wires allow orthodontists to create an integrative therapeutic protocol that combines much of the alignment, leveling and torque control in a single wire.

Introduction

Contemporary orthodontists hardly think of the ribbon arch much less use the slender wire, but it provided orthodontists with the first appliance capable of controlling teeth in three dimensions and provided Angle[1] the foundation upon which he built the edgewise system. Angle designed the edgewise appliance as an adjunct for the ribbon arch appliance rather than as a substitute for it.[2]

Few orthodontists published anything about the appliance during the 1920s when it enjoyed its greatest popularity, but they used it extensively, and it provided the basis for the Atkinson Universal appliance as well as for the Begg Lightwire appliance.[3] The result of this scarcity of information has been to obscure its obvious advantages and effectiveness and helped it go unnoticed by the vast majority of present-day orthodontists.

The Ribbon Arch appliance had rectangular bracket slots for the engagement of rectangular arch wires and bracket position was as critical to it as to the edgewise appliance.[4] Round wires were useful with both appliances, but the rectangular wires provided the means to precisely control teeth in three-dimensions. This latter feature served to distinguish these two mechanisms from others of the time and made them more effective.

The main difference between the Edgewise Appliance and the Ribbon Arch mechanism was the slot of the Ribbon arch bracket opened vertically with the greatest dimension in that direction, while the Edgewise bracket opened horizontally with the greatest dimension in that direction. Both could tip teeth facially and lingually, but the Edgewise bracket design gave it control over mesial and distal inclinations as well.

Both systems used horizontal tubes on the molars, but it was much more difficult to insert the ribbon arch into a horizontal tube from a vertically slotted premolar bracket. An additional feature that made this task difficult was the size of the Ribbon arch. Though it was considered a light-wire appliance in comparison to other mechanisms, it measured .036 inches at its widest cross section. Each system used small round arch wires to align and level the malocclusion.[5]

The rectangular Ribbon arch fitted accurately into the vertical slot with a matching .036 x .022 inch dimension and was held in place by a lockpin in each bracket,

almost identical to the Begg Lightwire bracket (**Figure 1**). Orthodontists could use headgears and intermaxillary elastics with the Ribbon Arch appliance, but it had its greatest successes with uncomplicated Class I and Class II malocclusions. It could quickly realign crowded and rotated incisors and open spaces for canines and premolars. Nevertheless, the Edgewise appliance controlled the premolars better in leveling and could effectively position the roots of teeth adjacent to extraction spaces. Vertically slotted brackets did not allow efficient control of extraction spaces until the addition of auxiliary vertical tubes that permitted the use of up righting springs.[6, 7]

The Ribbon arch exercised its greatest advantage by removing rotations in the horizontal plane. The wire was most flexible in this direction and by offsetting the bracket severe rotations were easily handled, unlike the Edgewise bracket. The Ribbon arch appliance also taught orthodontists the principles of torque control, bracket placement, rotation techniques, the value of rectangular wires and light wire applications. In short, the Ribbon Arch provided the background for the most sophisticated appliances we use today.

Contemporary Ribbon Arch Appliances

Orthodontists currently prefer to work with preadjusted appliances with loose fitting wire-bracket combinations.[8] Such *intrabracket* space around the wires promotes patient comfort, encourages fewer broken brackets and eases the insertion of wires for the orthodontist. Nevertheless, such lax wire-bracket affinity compromises control, which preadjusted appliances have built into them.

In 1975, Schudy developed and published an article regarding a modern day variation of the Ribbon arch.[9] The Bimetric appliance Dr. Schudy invented relies on .016 slots on the incisors and .022 slots on the posterior teeth. This permitted him to use a .016 x .022 archwire to completely fill the bracket slots. By twisting the wire 90˚ distal to the lateral incisors, the .022 dimension becomes a ribbon arch with all of its attendant advantages (**Figure 2**). Sliding mechanics for posterior teeth became more efficient when the .016 dimension stayed in the horizontal plane and gave.006 inch of freedom between the posterior brackets and the .016. X .022 wire.

Later, Gianelly[10, 11] developed a similar idea, but chose to use vertically slotted .022 x .028 brackets. The dimension of the arch wire was .022 x .016 in the incisors, while using .a wire dimension of .016 x .022 for posterior teeth. This allowed him to employ a .016 x .022 arch wire to completely fill the bracket slot in both anterior and posterior teeth by twisting the wire 90˚ as Schudy had previously proposed or to use sliding mechanics in the posterior with .006 inch of freedom. Later Gianelly changed the anterior bracket to .018 x .025.

These two latter-day Ribbon Arch methods require extensive changes in inventory, and they still rely on rather large and typical edgewise archwires. These features make the techniques less appealing. Also, it makes transferring patients to other clinics more difficult and confusing.

Integrative Orthodontic Therapy

Ribbon arches that fill the bracket slot would furnish orthodontists control, but simultaneously offer a gentle, light force, which patients could better tolerate. Such archwires made in titanium would also afford clinicians a wire that could avoid “phase

treatments", i.e., correcting rotations and bracket alignment with round wires in the first phase; a second phase of rectangular wires that complete the leveling and prepare the teeth for a final phase with finishing stainless steel rectangular wires.

A thin titanium ribbon arch would permit orthodontists to practice integrative therapy. That is, they could complete as many different orthodontic movements as possible with a single wire, e.g., rotational control, leveling of the occlusal plane and delivery of torque before moving into a final phase of treatment with an identical size wire made of stainless steel.

The Highland Metal Co of San Jose, CA has developed ribbon arch wires with the dimensions of .018 x .014 and .02175. X .016 in both titanium and stainless steel. Class One Orthodontics of Lubbock, TX provides the only available thermal titanium archwires, which greatly extend the usefulness of ribbon arches. The extra flexibility offered by the titanium variety allows its use early in treatment, and the stainless steel type offers clinicians a gentle yet firm finishing wire. Unlike the original Ribbon Arch technique, the current varieties offer good control of teeth adjacent to extraction spaces, and the available wires provide enough choice to satisfy almost any clinician.

The light forces created by the .018 x .014 titanium wires provide an ideal appliance for controlling first order or horizontal rotations, and this wire also controls mesial and distal inclinations in a superlative manner by completely filling the bracket slot. Fortunately, the forces delivered to the teeth by these arches are so low that they do not threaten bracket bonding, and this is particularly true when using the thermal variety made by Class One Orthodontics.

Dr. Schudy contended that lighter forces were more efficient and effective than those created by larger edgewise wires, but this remains an anecdotal observation. Nevertheless, the anterior torque produced by ribbon arch wires is so efficient that the maxillary incisors will need a restraining force in the form of a tieback or elastomeric chain to prevent them from separating within a few days of placement

Three-dimensional control early in treatment provides axial control of the teeth and prevents round-tripping them by continued alignment and leveling with round wires. Teeth assume natural axial inclinations with edgewise arches and the light .018 x .014 titanium wires allow this employment quite early in treatment, usually by the second wire.

Another huge improvement these new ribbon arches afford both doctor and patient is a closing arch that can deliver proper moment-to-force ratios to the anterior teeth. Burstone[12, 13] has recommended closing arches that deliver to the anterior teeth a moment-to-force ratio of 10 to 1, but large dimensional wires cannot achieve this. A simple Bull-loop closing arch will not achieve a proper ratio. Even a closing arch with a wire as small as a .016 x .022 stainless steel archwire will need a T-loop closing spring to approximate a 10 to 1 ratio. . However this wire will still not fully engage the anterior brackets, so more torsion must be added to the wire in order to deliver the correct amount of torque to the teeth.

The .018 x .014 stainless steel wire, on the other hand, will fully engage the anterior brackets and thus deliver the amount of torsion built into the preadjusted bracket slot. Simultaneously the closing loop can be a simple Bull-loop that is more comfortable for the patient and easier for the orthodontist to construct – but the .02175 x .016 will still

need a T-loop (**Figure 3**). Also the .018 x .014 stainless steel wire lends itself to sliding mechanics for space closure should the doctor prefer that method, but this technique makes moment-to-force calculations more difficult and problematic.

Clinicians will find the titanium variety of ribbon arches to have minimal bending capability, so bends will of necessity be simple steps or offsets. 90˚twisting bends to convert the .018 dimension to .014 cannot be performed nor can closing loops be fabricated by orthodontists. Nevertheless, when more complicated wire bends become necessary, clinicians can employ the stainless steel ribbon arch, which still offers some rotational control in the horizontal plane. The .018 x .014 stainless steel ribbon arch offers clinicians an excellent finishing archwire.

Clinical Results with the Integrative Orthodontic Technique

Patient 1

This patient presented with a typical Class II division 1 malocclusion whose saggital discrepancy was first treated with a Mandibular Protraction Appliance (MPA)[14-16] (**Figure 4**). The MPA provides a template for simultaneous correction of the midline, overbite, overjet and the Class II posterior occlusion. During this first phase a maxillary .018 x .014 titanium ribbon arch wire was employed to complete the alignment, torquing and rotation removal in the maxillary arch, while a larger stainless steel arch wire (.0175 x .025) supported the MPA in the mandibular arch. When the MPA corrected the Class II occlusal arrangement, a titanium .018 x .014 ribbon arch wire corrected discrepancies in the mandibular arch before employing stainless steel finishing ribbon arch wires in the maxilla and mandible.

Patient 2

This patient presented with a mild Class II malocclusion with a deep overbite and slight mandibular arch crowding. Class I mechanics pushed the maxillary posterior teeth distally, which resulted in spaces mesial to the canines that required a closing arch (**Figure 5**). A .018 x .014 stainless steel ribbon arch with Bull closing loops was employed to close the extraction spaces. Afterwards the mandibular teeth were bonded, aligned, leveled and torqued almost exclusively with a .018 x .014 titanium arch wire before finishing with stainless steel .018 x .014 arch wires in both arches.

Conclusion

As with any technique, ribbon arches have some disadvantages such as:

- Inability to deliver large forces;
- Inability to support auxiliary mechanics such as the Mandibular Protraction Appliance (MPA) or an archwire supported Herbst appliance.
- They are not yet widely available in multiple arch forms or made with beta titanium, and only one company provides them in thermally activated titanium (Class One Orthodontics; Lubbock, TX).

Nevertheless, ribbon arches provide orthodontic clinicians with an attractive, gentle wire that fully engages the vertical dimension of the bracket slot and gives a degree of control heretofore found only in full-size edgewise arch wires, which orthodontists avoid more often than they use.

References

1. Angle, E.H., *Some new forms of orthodontic mechanism and the reason for their introduction.* Dental Cosmos, 1916, **58**: p. 969-994.
2. Angle, E.H., *The latest and best in orthodontic mechanism.* Dental Cosmos, 1929. **71**: p. 164-174, 260-270, 409-421.
3. Dewel, B.F., *The ribbon arch.* Angle Orthod, 1981. **51**(4): p. 263-268.
4. Dewel, B.F., *Basic principles and techniques of the edgewise appliance in orthodontic treatment.* Trans of the European Orthodontic Society, 1966: p. 209-225.
5. Hawley, C.A., *The use of round wires in bracket bands preliminary to adjusting the ribbon arch.* Int. J. of Orthdont., Oral Surg., & Radiol., 1924. **10**: p. 786-794.
6. Begg, P.R.and Kesling, P.C., *The differential force method of orthodontic treatment.* Am J Orthod, 1977. **71**: p. 1-39.
7. Begg, P.R.and Kesling, P.C., *Begg orthodontic theory and technique*. 3rd ed. 1977, Philadelphia: W.B. Saunders Co.
8. Sheridan, J.J., *The Readers Corner.* J Clin Orthod, 2003. **37**(1): p. 27-29.
9. Schudy, F.F. and G.F. Schudy, *The Bimetric System.* Am. J. Orthod., 1975. **67**: p. 57-91.
10. Gianelly, A.A., Smith, J.B., Bednar, J.R. and Dietz, V.S., *A bidimensional edgewise technique.* J Clin Orthod, 1985. **19**(6): p. 418-421.
11. Gianelly, A.A., et al., *Asymmetric space closure.* Am J Orthod Dentofacial Orthop, 1986. **90**(4): p. 335-41.
12. Burstone, C.J. and H.A. Koenig, *Optimizing anterior and canine retraction.* Am. J. Orthod., 1976. **70**: p. 1-20.
13. Burstone, C.J., *The segmented arch approach to space closure.* Am. J. Orthod., 1982. **82**(November): p. 361-378.
14. Coelho Filho, C.M., *Mandibular Protraction Appliances IV.* J Clin Orthod., 2001. **35**(1): p. 18-24.
15. Coelho Filho, C.M., *The Mandibular Protraction Appliance No.3.* J. Clin. Orthod., 1998. **32**: p. 379-384.
16. Coelho Filho, C.M., *Clinical applications of the Mandibular Protraction Appliance.* J. Clin. Orthod., 1997. **31**: p. 92-102.

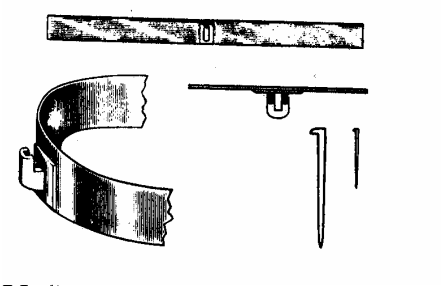

Figure 1: Original Rectangular Ribbon Arch

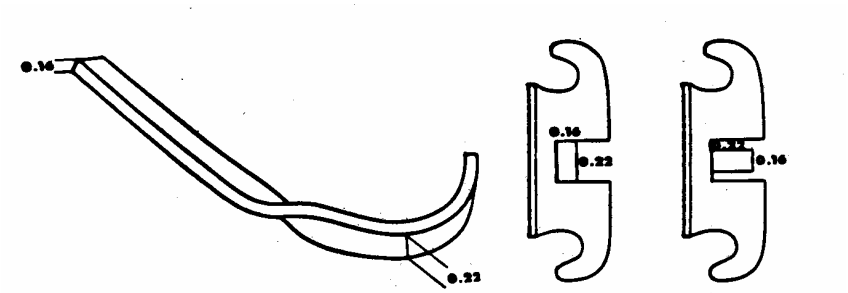

Figure 2: Twist of stainless steel wire that converts the vertical dimension to another size.

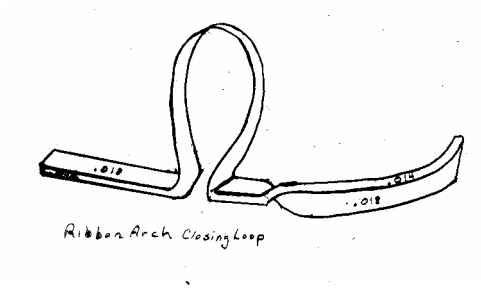

Figure 3: Bull loop closing arch made from .018 x .014 stainless steel ribbon arch.

Figure 4: Patient 1 before treatment

Figure 4: Patient 1 with .018 x .014 titanium ribbon arch wires. Note the maxillary elastomeric chain to prevent incisor flaring.

Figure 4: Patient 1 after treatment.

Figure 5: Patient 2 before therapy.

Figure 5: Patient 2 with ribbon closing arch.

Figure 5: Patient 2 with maxillary and mandibular titanium ribbon arches.

Figure 5: Patient 2 after therapy.