

Construction of A Habit Correction Roller With Arch Expansion: Chair Side Application of A New 2-piece Bondable “Bluegrass” Appliance



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Historically, orthodontists have relied on tongue cribs, hay-rakes and other sharp points, which employ an aversive negative stimulus to extinguish undesirable oral habits. Aversive approaches have proven to be only moderately effective, attaining some success in cases when patients desire to end their habit. In cases where the patient is ambivalent or non-cooperative, aversive approaches are generally ineffective or even counter-productive, and sometimes may trigger other habits or unexpected behaviors.¹

Since its general introduction in 1991 by Haskell and Mink, the “bluegrass appliance”, or “habit correction roller”, has obtained general approval both in this country and internationally^{1,2,3} the primary application of the Habit Correction roller is to introduce friendly, non-destructive oral habits replacing the common destructive habits: digit sucking and tongue thrusting. This new thoroughly effective and “friendly” alternative has drawn recent praise in habit control for avoiding the traditionally rooted principles of a formidable physical barrier (“crib”), as well as that of negative reinforcement (“spikes”). Instead, it acts similarly to the habit-reversal techniques practiced by behavioral specialists.⁴ Both digit sucking and tongue thrusting cause major orthopedic alterations to the skeletal structures of the oral cavity and lower face. The

resulting sequelae pose formidable challenges to orthodontists in correcting and maintaining a stable transverse dimension. An improved and effective treatment methodology was clearly called for.

When a free-spinning roller is placed in proximity to the tip of the tongue, a “fascination” response is quickly imprinted due to the intense sensitivity and neuromuscular nature of the tongue. Within a matter of only days the tongue will firmly establish the new non-harmful habit of “playing” with the roller. Establishing the new, non-destructive habit may take somewhat longer with older patients. The operative psychological mechanism is that the destructive habit is simply substituted with new, practitioner-encouraged non-destructive behavior. Roller-based habit correction therapy must be maintained for four to six months or longer, depending on the patient’s age, to insure that the new habit is firmly established. (The original undesirable oral habit may re-emerge if the new behavioral accommodation is not firmly established). Interestingly, the appliance has reportedly been used in the treatment of cerebral palsy patients to improve tongue placement, assisting the control of drooling.⁵

The traditional quad-helix-type transpalatal appliance works particularly well for positioning rollers appropriately in the vault of the palate. The roller is usually placed in close

proximity to, but avoiding impingement in the most superior / anterior portion of the palate. This is in a position similar to that of the Hays-Nance button.¹

Quad-helix therapy as popularized by Ricketts⁶, in conjunction with habit correction therapy creates a particularly efficient dual-treatment modality: The quad helix appliance is effective in correcting the habit-caused orthopedic “damage” while at the same time it provides an ideal basis for the habit correction (figures 1-5).



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5

Thus, the first goal of ending the habit is accomplished simultaneously with a transverse orthopedic correction of the constricted maxillary arch usually associated with vigorous and prolonged digit sucking. This author has found the dual-function of such an approach to be more efficient for both habit and morphologic modification than either action undertaken alone. Even though very effective in conjunction with quad-based transverse correction, rollers are of course not limited to application on quad-helices. They can be installed on any type of laboratory or commercially produced pre-formed trans-palatal appliance featuring a suitable transverse wire segment as has been reported by Baker.^{2,3}

One drawback encountered when using the first generation, one-piece bluegrass roller to correct both the habit and the sequelae of arch constriction is the complexity associated

with the fabrication of a suitable, supporting trans-palatal appliance. As can be appreciated, the one piece, first generation bluegrass appliance⁷ must first be threaded onto a suitable, straight piece of appliance wire. The appliance must then be bent and formed by hand, either at chair side or by a laboratory accompanied by impressions. Custom-formed appliances of this type are typically soldered to molar bands rather than fabricated to take advantage of vertical inserting or sheath-based fixed/removable attachment. Because of these inherent limitations, the first generation, one-piece roller cannot be added to the many currently available pre-formed and pre-sized arch width development products. Thus, the significant time and cost savings achievable through use of pre-formed appliances cannot be realized.

Using the old bluegrass-type one-piece roller with a soldered appliance typically relegates a practitioner to making adjustments intra-orally and to having access only to the two A-P palatal legs. A full adjustment of such an appliance combination (figure 5) requires removal, reshaping with pliers or by hand, followed by re-cementation.

Most of the commercially available trans-palatal correction appliances are based on a fixed/removable 'plug-in' attachment method. Chair side adaptation and activation of pre-formed appliances supporting the new type of a chair side or counter-top bondable roller could be of great benefit. A quad-helix with a habit roller or other similar assembly could simply be 'popped out' of the lingual sheaths, adjusted by hand (expanded), and easily re-inserted.

THE 'SPLIT' (BONDABLE) HABIT ROLLER

A new treatment approach is enabled, and the problems described above have been resolved through the use the new 2-piece, bondable version rollers. They are cast from the same medical grade material as is used for a successful and proven line of "composite" urethane orthodontic brackets. Like the successful brackets, the flat male and female features of both of the roller bonding faces are treated with a bond-strength enhancing

process called Micro-Rock™.⁸ The 2 halves are simply bonded together with any routinely used bracket adhesive system, and thus capture a wire segment in its free-spinning center. Secure and safe bond strength is easily achieved since the bonded faces are flat and ideal for bonding, as well as providing significantly more bonding area than any orthodontic bracket. Further, the forces acting on a roller located in the palate are obviously unlike the forces encountered by a much more precariously placed and structurally challenged bracket. Typically, the assembled habit roller is positioned on the anterior leg of the quad-helix and cemented together extra-orally, and at chair-side if desired (figures 6a, b, c,).



Figure 6a



Figure 6b



Figure 6c

The new 2-piece roller series consists of 3 configurations: A hexagonal version (5.25-

mm mesio-distal length, is used as the primary habit “re-trainer”, as its facets and edges create the greatest sensory feedback to the tongue. When bonded, an effective diameter of the hexagonal roller of 7mm is achieved. Two other versions with smooth, round outer surfaces are available in 5.25mm and 12mm mesio-distal lengths. These are smaller in outer diameter, at 5mm. All versions have an inner lumen of 1.5 mm allowing free spinning on any gauge wire likely to be used for constructing trans-palatal appliances. Both the hexagonal and round versions of the 5.25 mm long rollers have concave ends designed to accommodate the left and right palatal helices of a quad-helix, insuring smooth, friction-free spinning.

An unexpected side-benefit of the using habit correction roller therapy is one of reducing tongue irritation in patients undergoing traditional quad-helix or similar type expansion therapy, independent of whether or not habit correction is involved: During expansion therapy, severe irritation or deep indentations in the tongue can frequently occur, particularly with patients with large unruly tongues or shallow palates. Such irritation is caused by tongue interaction with the appliance. In these cases, early removal of the appliance has been seen as the only option available to the clinician. To counter this dilemma, the round versions of the bondable rollers can serve by providing smooth tongue-shielding or tongue-protecting surfaces on the central, anterior section of a quad-helix appliance. By adding a smooth roller as a tongue protector, appliance-induced irritation and the interruption of the physiological processes associated with palatal expansion can usually be avoided. (Figure 7)



Figure 7

Use of the new 2 piece bondable rollers can prevent a series of time-consuming interruptions involving the discarding of the original expansion appliance and the undertaking of an entirely different means of transverse correction.

TESTING

Because the new appliance is manufactured in a 2-piece configuration, it was essential to confirm adequate bond strength of the bonded assembly. 24 rollers were subjected to bond testing using four popular orthodontic adhesive systems: Mono-Lok, Transbond XT, Master Dent Light Cure and Fuji Light Cure¹⁰. The Mono-Lok-bonded sample halves were held in place for one minute and allowed to cure for 5 minutes. All other cements were bonded with a 60-second light cure. Testing was performed at the laboratory of the manufacturer; Advanced Products Inc., Leland North Carolina; a manufacturer of urethane orthodontic brackets and other orthodontic products.

The rollers were pulled apart with one wire looping up to the upper movable jaws of a Dillon Tensile Testing Machine with another wire looped downwards to the stationary jaws. Both wires (.030 SS) passed through the lumen of the bonded roller halves. This protocol created a concentration of forces at the ends of the rollers and a peeling action against the bond. The peeling motion permitted the roller to unnaturally flex due to the concentration of forces at the ends. Bond failure propagates as the material of the roller flexes. Only a small portion of the bond actually becomes loaded to failure at any given time during a test pull.

In testing the bond strength of brackets for example, known failure modes can be duplicated by test fixturing. In the case of rollers, it is much more difficult to anticipate destructive force vectors since all forces are radial. The testing methodology used by the manufacturer was therefore thought to serve as providing relative bond strength values, useful for future reference. This means that the actual bond strength is likely far higher than reflected in the test.

RESULTS

Average bond strengths	Ranges	Conversion to pounds per in ²
Hexagonal 5.25 mm Roller: 28.92 pounds	18.39 - 34.76	751 psi
Round 5.25 mm Roller: 30.45 pounds	22.46 - 38.00	927 psi
Round 12 mm Roller: 27.68 pounds	20.57 - 46.61	403 psi
Overall Mean: 28.63 pounds		

DISCUSSION

The highest strength bonds, or those with pieces of fractured roller halves still adhering to each other after the destructive shear, were obtained with Mono-Lok and Transbond XT. The typical value for the shearing of a maxillary lateral incisor bracket is typically 18 – 22 pounds, a loading that must withstand the shearing stress of candy, ice, etc. The loading, which can impinge upon a passive roller located at the top of the palate, is likely an order of magnitude less than the forces encountered at any bracket during chewing.

GENERAL ORIENTATION FOR BONDING AND ADAPTING

Bonding

Virtually all commercially available orthodontic bracket bonding adhesive systems are compatible with the material of the rollers. Light-curing systems are recommended in particular in that they utilize the roller's translucent optical properties. Step-by-step instructions are provided below.

Note: Avoid contamination of the bonding surfaces. Plastic bracket primers used with polycarbonate “plastic” brackets are not indicated.

Locating the rollers in the palate

The appliance receiving the rollers should be adapted to locate the roller just free of soft tissue in the deeper part of the anterior area of palate. Adapt and activate the appliance in accordance with the proper sizing and treatment objectives as you would normally. Fixed/removable-type appliances utilizing horizontal lingual sheaths or vertically inserting posts are particularly convenient for both bonding

of the rollers as well for subsequent removal and re-activation.

Orienting the roller halves for bonding

In the process of installing a roller on an appliance, one roller half is adhered to a double-sided adhesive pad (supplied by the manufacturer) and thereby held stationary on the work surface. With one roller half held stationary, the receiving wire section of the transpalatal appliance is first coated with a release agent to prevent inadvertent interaction with the bonding materials. The appliance is then oriented to passively rest in the central trough of the stationary roller half. After applying adhesive, the two halves are brought together in self-alignment and squeezed with gentle pressure to fully seat.

Excess adhesive is removed and the bond is allowed to cure chemically or with a light source as the case may be. Doctors and staff accustomed to the routine bonding of brackets must understand that since there is no mesh or bonding substrate topology associated with the bonding surfaces of the rollers, a significantly reduced amount of adhesive is required. An ideal thin adhesive mass results from the bonding of the true, coplanar surfaces.

INSTRUCTIONS

1. Armamentarium

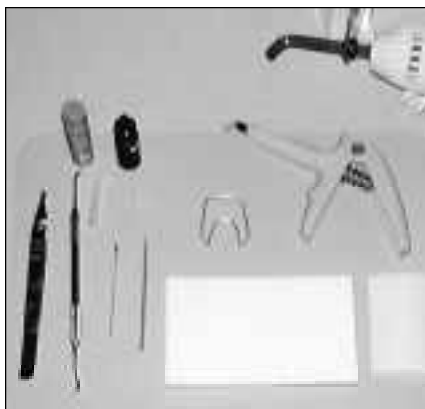


Figure A: Typical roller-bonding set-up. In addition to the instruments and materials you normally use for orthodontic bracket bonding, you will need a release agent such as cement-guard, Vaseline or silicone grease, an arch marker and double-sided adhesive pads.

2.Preparation



Figure B: Remove both peel sheets from the double-sided adhesive pad and adhere it to a piece of tray-paper as shown in Figure B. (Do not apply the adhesive pad to a bare work surface.)

3. Temporarily assemble and mark roller

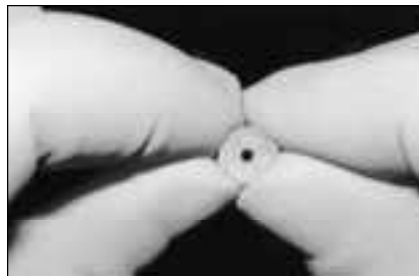


Figure C: Orient the interlocking features of the rollers so that they fit together as shown in figure C. Place a visible reference mark across the parting line of the two roller halves for later reference as shown in Figure D



Figure E: Apply a release agent (Cement-guard, Vaseline, silicone grease or rope wax) to the wire segment over which the roller will be bonded as shown in Figure E.

4. Stabilize one roller half for bonding

Place one of the halves on the double-sided adhesive pad. Placement should be centered along a long edge and parallel to that edge, with the roller's bonding surface oriented "up."

5. Prepare appliance for bonding

(Figure E)

6.Apply adhesive



Figure F: Adhesive is first applied to the stationary roller half as shown in figure F. Apply primer or adhesive (as the case may be) to the stationary roller while following the sequential instructions supplied with that bonding system. Apply all adhesive components very sparingly so that excess adhesive will not express into the central trough of the roller. Next, orient the appliance's roller-receiving wire segment so that it rests passively in the central trough of the stationary roller.



Figure G: Apply adhesive components to the other roller half while holding it with a bracket pliers as shown in Figure G. Again, in all cases, apply the bonding system components very sparingly so that no excess adhesive will interfere with the desired free spinning of the roller.

7. Mate halves

Orient the hand-held roller relative to the stationary roller using the reference mark made in step 3 as shown in Figure H. Using gentle pressure, push both halves together until completely seated. Remove excess adhesive as shown in Figure I. Allow adhesive to cure, or cure with light if using a light curing adhesive system as shown in figure J.

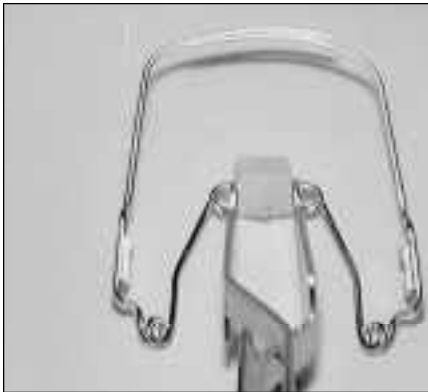


Figure H



Figure I



Figure J

Remove assembly from the double-sided adhesive pad.

8. Check for freedom



Figure K: Inspect and confirm that the roller can spin free and true as shown. Confirm that the roller halves are secure and bonded uniformly together. After inspection the appliance is generally ready to be placed in the mouth. If necessary, rollers can be removed from appliances using a hard-wire cutter or similar instrument (using care not to nick or damage the appliance)

NOTES

Both the hexagonal roller and the two round rollers are installed in the same manner outlined in the instructions above. The short round roller (5.25-mm) can be placed for habit correction and/or tongue protection as shown in figure L.



Figure L

CONCLUSION

A 'split' habit roller technique has been described which will hopefully enhance the utilization and effectiveness of the traditional

bluegrass appliance as originally reported by Haskell and Mink¹. Laboratory verification of the strength of the two roller halves has shown such a technique may be used with confidence provided that directions as outlined are followed. A combined elimination of harmful habits with simultaneous maxillary width development would seem to be a more efficient methodology and is recommended. ☀

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To order rollers for use in your office, go to www.haskellbraces.com, and click on "Habit Modification."

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