

Clear Collection instruments for clear aligner treatments

In part 1 of a series, Dr. S. Jay Bowman explores instruments that help increase the utility of aligners and expand the scope of appropriate applications

Let's be clear: enhancing aligner treatments

As clear aligner treatments have evolved and been progressively refined in the past 15 years, more advanced applications and increasingly complex malocclusions have been addressed.¹⁻⁴ In addition, there has been more interest in tackling some of the specific limitations of moving teeth with plastic.⁵⁻⁷ Obviously, the progress of orthodontic treatment with traditional wires and braces has been advanced throughout the past century, but the techniques associated with a sequence of aligners are relatively recent phenomena.

Orthodontists with the most experience and enthusiasm in using aligners have worked diligently to improve the concept through better understanding of the limitations involved in more advanced treatment planning, especially when using adjuncts to enhance the associated biomechanics.^{4,8-13} The Clear Collection of instruments from Hu-Friedy (Chicago, Illinois, at www.hu-friedy.com) was developed with that aim in mind; namely, to help to increase the utility of aligners and expand the scope of appropriate applications (Figure 1).¹³



Figure 1: Hu-Friedy's Clear Collection of instruments designed to enhance clear aligner treatment (Images courtesy of Hu-Friedy Mfg. Co., LLC, Chicago, Illinois)

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“Innovation is taking two things that already exist and putting them together in a new way.”

– Tom Freston

Adding intra- and intermaxillary forces

The Clear Collection instruments have streamlined and standardized some procedures that orthodontists had already been providing, while opening up more options for other methods to accentuate or refine treatment. In the past, attempting to add intermaxillary elastics for correction of Class IIs, IIIs, or midlines was problematic.

Some were cutting notches in plastic trays using scissors or nail clippers¹⁰ or attempting to adhere buttons to the trays — all unwieldy endeavors.

The Tear Drop

There are occasions when orthodontic elastics are needed to assist with specific tooth movements or growth modification when using aligners. For instance, it may be beneficial to add elastic hooks or bonded buttons in different locations along the arch form on either the buccal or lingual. It would be beneficial to incorporate an elastic hook that cannot be dislodged from the aligner and that only requires a simple one-step squeeze of a pair of pliers to create. Most importantly, a hook that actually holds the elastic in place on the aligner.

The Tear Drop pliers (Figure 2) is an instrument created for the purpose of adding a notch or hook at the gingival margin of clear aligners. A standardized notch is easily cut in a single step, creating a teardrop-shaped “reservoir” to hold the elastic on the tray (Figure 3), thereby making



Figures 2A-2D: The Tear Drop pliers was created to produce a notch in clear aligner plastic to facilitate the application of orthodontic elastics



Figures 3A-3B: Teardrop-shaped hooks retain elastics when aligners are seated, making the addition of “rubber bands” easier for patients to manipulate. Notches are made at an angle to resist forces applied by the elastics



Figures 4A-4B: The Hole Punch pliers was created to produce a half-moon cutout to permit the addition of bonded buttons or brackets



Figures 5A-5B: A variety of methods to connect orthodontic elastics can be added to clear aligners using the Hole Punch and the Tear Drop instruments. 5A. Class I intramaxillary elastics connected from teardrop hook to a miniscrew (i.e., to support molar distalization) plus Class II intermaxillary elastics from teardrop notch to bonded button. 5B. Intermaxillary elastics hooked to bonded buttons to assist with seating of teeth into aligners and improve occlusion



Figures 6A-6D: The Hole Punch pliers can be used to relieve plastic impingement of gingival tissues anywhere along the aligners (e.g., incisive papilla irritation)

it easier for the patients to seat their aligner and connect their elastics. In this manner, the patient is not fumbling with elastics, attempting to hook them in two locations since the elastic accompanies the aligner as it is seated over the teeth.

Teardrop notches should be cut at an angle to resist the line of force of elastics that are being employed (e.g., the notch is angled anteriorly at the mesial of the upper cuspid for Class II elastics; Figure 3). These hooks can be added anywhere along the clear aligner arch at the gingival margin on either the facial or lingual, whenever elastic forces need to be applied.

The Hole Punch

The Hole Punch (Figure 4) is used to cut a half-moon shaped hole at the gingival margin of aligners. These half-circle cuts permit the addition of bonded buttons, bonded orthodontic tubes or brackets with associated hooks, or are simply used to relieve impingement of plastic on soft tissue. The Hole Punch can be used to produce cuts on either the facial or lingual of any tooth, anywhere along the aligners, whenever needed. Buttons bonded to teeth, rather than to the trays, do not cause dislodgement of the aligner.

During the progress of some patients' treatments (after a series of aligners has already been fabricated and delivered), an orthodontist may wish to add elastics. Bonded buttons can be added to hook up Class II or III intermaxillary elastics, bite-seating elastics, Class I intramaxillary elastics to miniscrews (Figure 5), or elastomeric chain connected to buttons to correct dental rotations. The combination of buttons on molars (plastic relieved using the Hole Punch) along with elastic hooks cut into the plastic at the cuspids (using the Tear Drop) is a common method of employing orthodontic elastics.

In other instances, aligners will occasionally impinge upon gingival tissues and cause gingival pain or inflammation. The

Hole Punch can be used to clear the impingement of plastic in each of a series of aligners. A common location for that type of irritation is at the incisive papilla, behind the maxillary central incisors (Figure 6). Nipping along the gingival margin of a tray with the Hole Punch is also an option to relieve marginal gingival impingement on either the buccal or lingual.

Bootstrap mechanics

If certain teeth are not “tracking” or are lagging¹³ behind (i.e., not fitting into the tray; Figure 7) Aligner Chewies™ are employed (Chewies™ Aligner Tray Seaters, Dentsply Raintree Essix, York, Pennsylvania). Patients are asked to hold the Chewie between the teeth in question and squeeze 10-15 seconds, release, and repeat for 5 minutes, 2-3 times per day^{8,13} (Figure 8). In addition, Chewies are routinely used for the first few days when patients switch to a new pair of aligners to help them seat more completely.

Another option is to add elastics to forcibly erupt the teeth into the aligner tray.^{13,14} There are several methods to generate so-called “bootstrap mechanics” (Figure 9):¹³

1. An orthodontic elastic is stretched over the plastic aligner to connect to a combination of bonded buttons on both lingual and buccal of the tooth.
2. A bonded button is placed on the lingual of the tooth (plastic cleared with the Hole Punch). The Tear Drop notches are cut into the tray

at the gingival embrasure spaces in the buccal plastic on both the mesial and distal of the problematic tooth, and an elastic hooked from the buccal notches and stretched over the aligner tray to the button to produce an extrusive force.¹³

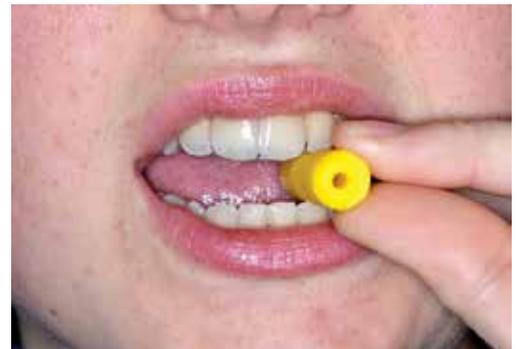
The Tear Drop and/or Hole Punch cuts are made in each tray in the series

of aligners prior to their being delivered to the patient. This concept is also useful when the extrusion of a tooth is needed for restorative purposes.

Other biomechanics that benefit from the application of elastic forces to aligner trays include the correction of severe rotations, posterior or anterior intrusion mechanics for open bites,^{11,12} and forces to control



Figure 7: Aligner “lag” or lost tracking is most often characterized as an “air gap” between the incisal or occlusal of teeth and the plastic, indicating teeth are not following the prescribed tooth movement¹³



Figures 8A-8B: Aligner Chewies are held tightly between specific “lagging” teeth for 10-15 seconds. This process is repeated for 5 minutes, 2-3 times daily, especially when changing to a new pair of aligner trays



Figures 9A-9C: Bootstrap mechanics¹³ to forcibly erupt a “lagging” tooth using orthodontic elastics (9A-9B). The Hole Punch is employed to clear aligner plastic to permit the addition of bonded buttons. The Tear Drop is used to cut notches in mesial and distal embrasures (9C-9F).



Figures 9D-9H: The Tear Drop is used to cut notches in mesial and distal embrasures (9C-9F). Orthodontic elastics are stretched from the button to the teardrop notches or to another button on the opposite side of the tooth (9G-9H)

anchorage during molar distalization or en masse movements when employing miniscrews (Figure 5).¹³ Cutting notches and relieving the plastic to add buttons or brackets facilitate the application of these innovative mechanics.

It is important to remember that indiscriminate alteration of the integrity of clear aligners may reduce their structural strength or may impair the intended biomechanics programmed into an aligner.

The instruments in the Clear Collection help the orthodontist to better customize clear aligner treatments, enhance their desired biomechanics, and streamline the addition of adjunctive forces during the course of a series of aligners. For information on the use and applications of the Clear Collection, instructional videos are available on YouTube at <https://www.youtube.com/watch?v=hrs2VfnImLY>.

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Clear Collection instruments for clear aligner treatments: part 2

In part 2 of a series, Dr. S. Jay Bowman continues his look at instruments that help increase the utility of aligners and expand the scope of appropriate applications

Contact points to accent aligners

The two accent pliers in the Clear Collection (i.e., The Horizontal and The Vertical) (Figures 1-2) were designed to enhance desired tooth movements by employing “contact points.” Although overcorrection is a critical aspect that is integral to aligner treatment planning, there are occasions when the virtual setup does not predictably produce the desired result. In fact, researchers have reported that a percentage of tooth movement prescribed for a setup is simply not translated from plastic into the dental results.¹⁻⁴ The flexibility of plastic, the potential errors transmitted from inaccuracies of PVS or scanned “impressions” and creation of models, imprecisions in the vacuum process of fabricating aligners, and the fact that all teeth do not move to the same degree when exposed to forces exerted by the trays can all lead to incomplete correction.

To improve the predictability of desired tooth movement, The Vertical and The Horizontal pliers were designed to produce shallow impressions in the aligner plastic to contact specific surfaces of individual teeth. These indentations are intended to generate an enhanced “contact point” and/or to create a mechanical couple to move a tooth in a desired direction. These “accents” may help avoid another series of “refinement” aligners with their attendant additional scans/impressions and associated virtual setups — potentially reducing treatment delays and the “hassle factor.”

The Vertical

The control of rotations is often a challenge with clear aligners. The Vertical

“We will control the horizontal. We will control the vertical. You are about to participate in a great adventure. You are about to experience the awe and mystery which reaches from the inner mind to —”

— “The Outer Limits” TV Series (1963)

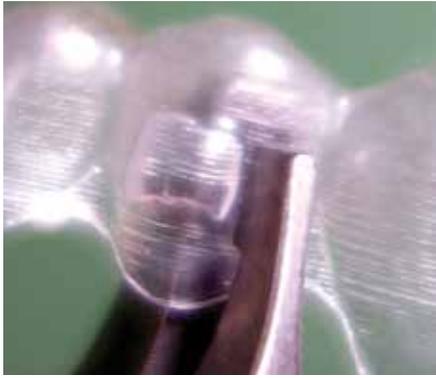
(Figure 1) is an instrument designed specifically for enhancing the correction of rotated teeth with clear aligners or even during minor tooth movement when using simple, clear retainers. Rotating upper laterals and cuspids is often problematic,^{5,6} especially since aligners do not have a large surface area contact on laterals. Consequently, these incisors can get left behind, resulting

in another form of “lag” or loss of tracking. The Vertical is used to produce an indentation at the mesial or distal of a specific tooth in the facial and/or lingual aspects of the aligner plastic. These indentations are made without heating the pliers and at a very shallow depth so as to not compromise the integrity of the plastic (Figure 1). The intent is to add contact points to accent



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Figure 1A-1F: The Vertical pliers are used to accent rotational tooth movement.



Figures 1G-1I: The shallow indentations are produced without heating the pliers, producing “contact points” to assist with rotational couples, including situations with composite “attachments” (1G, 1H), enhancing molar distalization (1I), or root paralleling



Figures 2A-2C: The Horizontal pliers are specifically designed to add individual root torque

the rotational couples that were prescribed when creating a virtual treatment setup. This certainly contributes to the concept of over-correction that is key to correcting rotations with aligners.

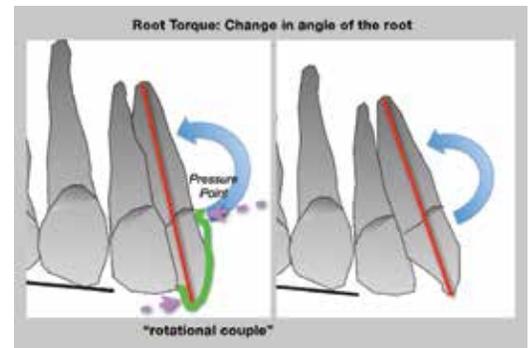
The Vertical can also be used at the line angles of teeth to accent other types of tooth movement. For example, placing a vertical indent at the mesial of maxillary first molars (in the buccal and/or lingual plastic) will enhance molar distalization (Figure 1). When placed at the distal, the indent will assist molar protraction. Vertical indents at the embrasures of incisors or premolars will assist root paralleling, especially in extraction scenarios.

Another option is to use The Vertical to produce a very slight indent at the junction between the incisal or gingival surface of the plastic and a composite aligner attachment. This may enhance the sharpness of the conformation or contact between plastic and attachment to avoid loss of tracking noted as an “escaped attachment.” The Vertical can also be used to produce an indent in aligner plastic in the middle one-third of the facial or lingual of a tooth to give a mild nudge for in-and-out or labiolingual discrepancies, including minor tooth movement with clear retainers.

The Horizontal

There are instances where we would like to accentuate root torque for specific teeth during clear aligner treatment. In other instances, there is a need to increase the retentiveness of aligners or clear retainers. The Horizontal (Figure 2) is an instrument designed to accent labial or lingual torque for individual teeth, and it can also be used to simply increase the retentiveness of clear aligners or retainers.

Either labial or lingual root torque can be a challenging aspect of tooth movement for clear aligners. This is typically due





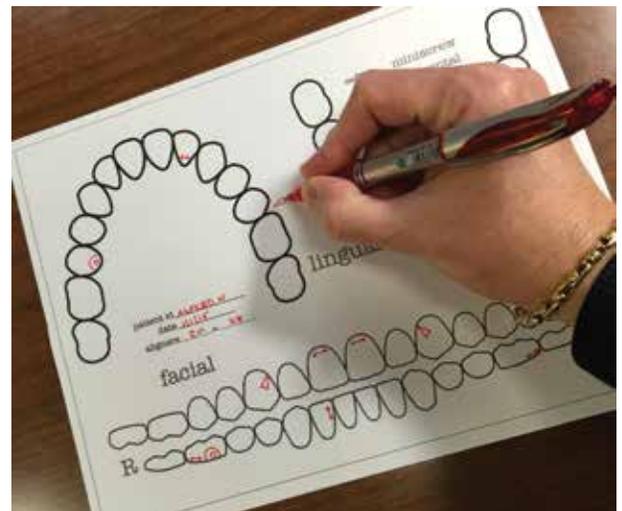
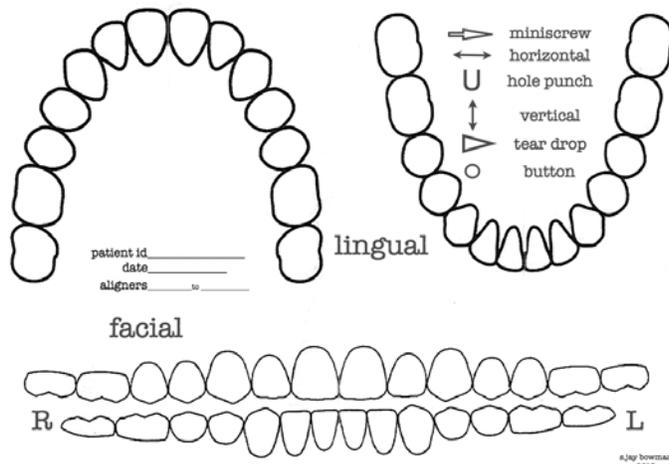
Figures 2D-2F: In addition, the Horizontal is used to reduce “lag” by accenting extrusive or intrusive movement by applying contact points immediately adjacent to composite attachments

to the fact that the plastic is more flexible near the gingival margins, diminishing the required forces. The Horizontal can be used to produce an indentation on either the lingual, buccal or both sides of the aligner, anywhere along the aligner plastic to emphasize torque (Figures 2A-2B). Commonly, these “impressions” in the plastic are positioned at the gingival margin on the facial of an incisor to apply a contact point to emphasize lingual root torque. In contrast, the indent is placed on the lingual to enhance labial root torque.

Another option is to use The Horizontal to produce a very slight indent at the right angle junction between a rectangular aligner composite attachment and the facial surface of a tooth (Figures 2C-2E). This indent may enhance the sharpness of conformation or contact between the plastic and the attachment to reduce the risk of lost tracking during either intrusive or extrusive movements. The Horizontal can also be used to produce a mild force to address labiolingual discrepancies (like The Vertical) — pushing a tooth facially or lingually. Finally, the Horizontal can be utilized to place an indent at the undercut of the crown of a tooth near the gingival margin to enhance the retentiveness of aligners (Figure 2F).

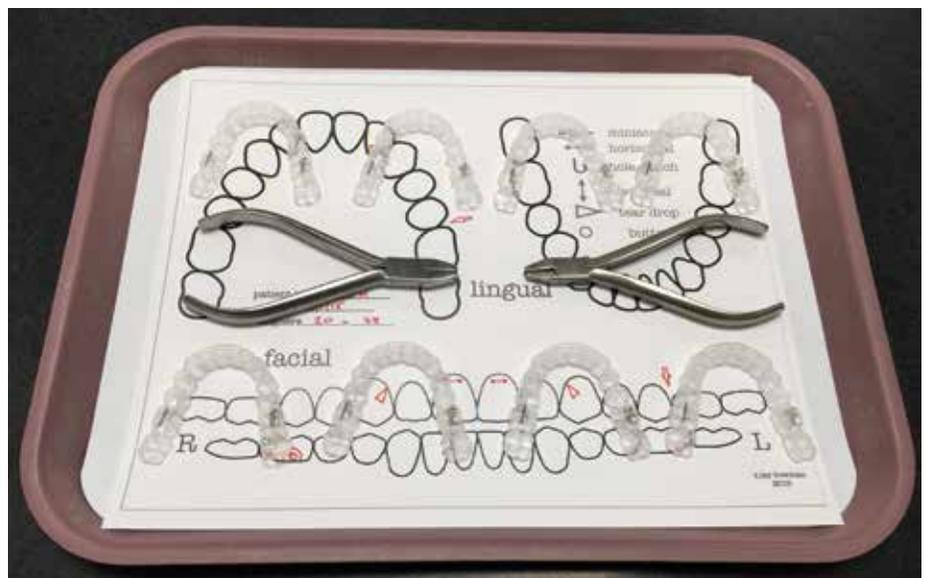


Figure 2G: Indents can also be created to increase the retentiveness of aligners or retainers



Standardized clinical process

In order to streamline the process of integrating individualized enhancement for a series of aligners, a prescription form is used to note the specific sites where Clear Collection instruments will be applied to each tray (Figure 3). In preparation to address each aligner, the prescription is completed in anticipation of the specific procedures needed for the trays. Notes regarding any mechanics to be employed are added (e.g., Class II elastics, bootstrap elastic, chain for rotation, molar distalization, protraction, intrusion, extrusion, etc.). The prescription accompanies the aligners that are to be dispensed at the patient's next appointment along with the necessary Clear Collection pliers needed. A copy or scan of the prescription is kept for reference in the patient's chart. In this manner, clinical coordination and consistency are communicated clearly.



Figures 3A-3B: Clear Collection prescription sheet is prepared for each patient to specify the instruments that will be used for a series of aligners along with the exact sites where they will be employed. Figure 3C: Completed prescription sheet with notations (in red) accompanies the required instruments and the series of aligners to be enhanced. A copy of the Clear Collection prescription sheet is available for download and duplication at: <http://www.hu-friedy.com/clear-collection>

Clear conclusions

The Clear Collection can assist in the application of adjunctive forces to broaden the variety of malocclusion problems that may benefit from aligner treatments. Enhancing and accentuating chosen biomechanics helps reduce the known limitations of aligners and orthodontists' occasional frustrations. In this manner, the clinician can more efficiently individualize treatment for each patient by altering the aligner trays in a series by adding appropriate forces to affect desired tooth movements. Specifically, The Hole Punch and The Tear Drop instruments facilitate the addition of elastic forces necessary for the correction of a significant number of malocclusions. Much like bending wires with orthodontic pliers, The Vertical and The Horizontal provide an

added dimension for individualizing specific tooth movements in "real time" at the clinic chair.

The instruments in the Clear Collection help the orthodontist to better customize clear aligner treatments, enhance his/her desired biomechanics, and streamline the addition of adjunctive forces during the course of a series of aligners. For information on the use and applications of the Clear Collection, instructional videos are available on YouTube: <https://www.youtube.com/watch?v=hRS2VfnImLY>. **OP**

Enhancing and accentuating chosen biomechanics helps reduce the known limitations of aligners and orthodontists' occasional frustrations.

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