DamonSystem

The Workbook

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Introduction

Over the past few years, I have had the opportunity to lecture in many parts of the world. It is very interesting and informative to observe the reaction of clinicians when exposed to a "new way of looking at our clinical force systems." I have been very proud of so many in our profession who have constantly been seeking a better way to help take patient care to a higher level. After spending nearly 20 years carefully evaluating the rationale of my clinical mechanics, it became very apparent that I was using a force system that was simply not "biologically sensible." It made very little sense to be using a bracket system to move teeth along an archwire that was tightly tied. To overpower this binding and friction, we have found it nearly impossible to use forces that are consistent with biologic principles of tooth movement.

I would encourage clinicians not to look at this technology as only a new bracket. It is a system that has been developed to try to match each phase of treatment with the natural force systems of normal growth and development. It is so apparent that if the clinician can apply the appropriate biologic force at the right time of treatment, the impact can have a profound positive effect on efficient tooth movement.

Any change that comes along in our lives can be very challenging to accept. This simply is human nature. Think of how long it took clinicians to accept the incredible advancements of the Straight-Wire Appliance or direct bonding of brackets to teeth. All of these changes have been paradigm shifts in our thinking. It is human nature to be uncomfortable with change. This is the very reason that this Workbook has been put together. If viewing the following cases helps clinicians adapt to the system, then all the time spent is worth the effort! It is a work in progress as we continue to understand the incredible benefits of this System.

The following cases have been selected for the purpose of challenging our treatment planning thought process and to demonstrate new techniques in treating complex cases with this low-force/low-friction System. It is intended to give the clinician a chance to view the impact of this technology on a patient's profile, face, bone, tissue, and the whole oromuscular complex. I was encouraged recently to hear a world renown researcher and academician say, "It is time for clinicians to treatment plan looking at the face." If the clinician thinks of this new technology only in terms of a "bracket" and uses conventional mechanics and treatment planning, the benefits of minimizing friction and binding has been shown through research to be a 25% decrease in treatment time, however, the big change comes when the clinician utilizes this low-force system to expand treatment planning options. Hopefully this Damon Workbook will encourage clinicians to challenge their own thought process and take their patient care to a higher level. This higher level of care is about "face-driven orthodontics" achieved more efficiently and with greater patient comfort.
Why use the word "System" when speaking of this new approach to clinical orthodontics? "System' is the blending of passive self-ligating brackets and high-technology archwires carefully selected to keep the applied force in the "Optimal Force Zone" in each of the four phases of treatment. These four phases of treatment include:

In the initial NiTi light, round-wire phase, arch-wires are carefully selected to minimize binding between the "tube" of the passive ligating bracket and the archwire. This allows sliding of the teeth and brackets along the wire as they start to level and align. Binding and friction in a conventional mechanical system comes from the ligature pushing on the wire and the seating of archwire against the base of the slot. There is also the binding created by the deflection of the archwire against the sides of the bracket slots in crowded cases. In recent years, many clinicians have started cases placing large dimension rectangular NiTi archwires with the intent of controlling torque to minimize the dumping of the incisors as teeth level and align. With the Damon System, the intent of the initial light round archwires is to apply just enough force to stimulate cellular activity without crushing the vascular supply in the periodontium. This has been defined as staying in the"Optimal Force Zone" or Biozone. If the appropriate force is applied, the muscles of the face and lips give a "lip bumper" effect on the incisors, minimizing anterior tipping. The intent of the initial archwire is not to remove all of the rotations but to align teeth and bracket slots just enough to move to the second phase of archwire progression. This is best accomplished by taking advantage of using a small-dimension archwire in the large lumen of the bracket. An analogy of this phase of treatment is a car being driven on both sides of a curving highway to straighten out the bends in the road. This same principle of archwire and tube helps minimize the force and binding friction.

To summarize: the initial phase starts tooth movement, rotation control, leveling, aligning, arch form, and prepares for the second phase of archwire sequencing.

The second, or high-tech edgewise phase, is the "heart and soul" of the System. This phase starts working on torque, root angulations, levels, completes rotation control, continues arch form development, consolidates space in the anterior segments, and prepares for the third phase of archwire sequencing. **IT IS CRITICALLY IMPORTANT TO TAKE A PANOREX AND EVALUATE ROOT AND BRACKET POSITION BEFORE PROCEEDING TO THE MAJOR MECHANICS PHASE OF TREATMENT.**

The third, or major mechanics phase of archwire sequencing, is the working phase of treatment. This includes posterior space closure, anteroposterior dental correction, and adjusting buccolingual discrepancies. Stainless steel archwires are primarily used to mainting vertical gnd buccolinguo control during this major mechanical phase of treatment.

The fourth phase is the finishing and detailing phase of archwire sequencing. If adjustments and torque requirements are minimal, the working archwire can be used to complete treatment. If moderate bends and torque are required, it is strongly recommended to use edgewise TMA. This gentle archwire makes finishing easy for both patient gnd clinician. Before detoiling archwire selections, I would like to emphasize the enormous vorigble in pgtient
response to the recommended archwires. I strongly encourage clinicians to choose archwire sizes very carefully and not just based on "What can I get in?" or "Patient tolerance." Choose the correct archwire size and give it time to work!

ARCHWIRE SEQUENCE FOR .022 BRACKETS

LIGHT ROUND WIRE PHASE

.014 NiTi SE Initial archwire - Start tooth movement, leveling, begin arch form development, prepare for next archwire.

.016 NiTi SE
Used occasionally as second archwire in severely crowded adult cases that are not quite ready for the second phase archwire.

HIGH-TECH EDGEWISE PHASE

.016 x .025 NiTi SE
The workhorse of the second phase. Placed in upper and lower well-prepared arches. If this wire is too difficult to engage, insert .014 x .025 NiTi SE - this is critically important!

.014 x .025 NiTi SE
A great transition wire. Used extensively in lower arches with less interbracket distance.

.018 x .025 NiTi SE
Followup archwire if .014 x .025 NiTi SE is used. Excellent wire to prepare for insertion of the working stainless steel transition wire.

.017 x .025 NiTi SE
Used with 20° of anterior torque and reverse curve; superb for division 2 second wire. If only intrusion needed, use the same size wire without the torque in the anterior.

.019 x .025 NiTi SE
Used with 20° of anterior torque and reverse curve. Great followup wire on challenging division 2 cases. If only intrusion needed, use the same size wire without torque in the anterior.

MAJOR MECHANICS PHASE

.019 x .025 SS Preposted Excellent archwire to maintain integrity of arch. During anteroposterior correction and closure. Great for maintaining the anterior vertical and posterior buccolingual.

.016 x .025 SS Preposted Used in lower arch when more play is desired. Nice finishing archwire in lower arch if all the torques are acceptable.

FINISHING PHASE

In most cases, the working archwires are kept in place and used to finish the case. If more bending or torquing of archwires is needed to finish, .019 x .025 or .017 x .025 TMA archwires are excellent choices.
Selective Torques:
How to use Selective Torques to treat cases in less time with more control.

One of the biggest advantages of passive self-ligation is to maintain play in the mechanical system during all phases of treatment. It has become very apparent that it is undesirable to totally seat the archwire against the base of the archwire slot during orthodontic treatment with very few exceptions. Obviously, it is an advantage if the intent of the clinician is not to move teeth along the archwire. With conventional mechanics and active self-ligation, the archwire is totally seated against the base of the bracket slot during some or all phases of treatment. This binding and friction obviously makes closing spaces, leveling, arch form changes, closing openbites, and the finishing, settling and detailing of the occlusion far more challenging. To best utilize the clinical advantage of passive self-ligation brackets, it is strongly recommended not to exceed .019 x .025 archwire dimension in an .022 bracket slot. This needed play allows for 7° of torque play in both directions. The intent of using multiple bracket torques is to help maintain torque control while keeping play in the mechanical system. The impact of using selective torques is shorter treatment times through greater torque control.

Example:
In first bicuspid extraction cases, the upper and lower cuspids have the tendency to tip lingually as the space is closed. To prevent the clinical crown from tipping, select +7° of torque. With 7° of torque play between an .019 x .025 archwire and the .022 slot, the position of the cuspids will be maintained at the desired 0°, keeping the root in medullary bone and in excellent position without having to bend the archwire.
Damon Prescription

**UL - Upper Central Incisors**

+12° Torque  +5° Tip  0° Rotation
- The standard torque prescription selected when central incisors are in good position with minimal requirements for treatment mechanics

+17° Torque  +5° Tip  0° Rotation
- Selected for division 2 cases
- Cases needing extensive Class II elastics - prevents loss of torque control resulting from elastic wear
- Most extraction cases to prevent loss of torque control when retracting anterior teeth

+7° Torque  +5° Tip  0° Rotation
- Centrals requiring extensive uprighting
- Case needing extensive Class III elastics - prevents loss of torque control resulting from elastic wear
- Extreme crowding cases combined with anterior tongue thrusting or thumb - finger habit
- Where extensive arch length needs to be gained and the incisors have near normal torque angulation

**U2 - Upper Lateral Incisors**

+8° Torque  +9° Tip  0° Rotation
- The standard torque prescription selected when central incisors are in good position with minimal requirements for treatment mechanics

+10° Torque  +9° Tip  0° Rotation
- Selected for division 2 cases
- Cases needing extensive Class II elastics - prevents loss of torque control resulting from elastic wear
- Most extraction cases to prevent loss of torque control when retracting anterior teeth

+3° Torque  +9° Tip  0° Rotation
- Laterals requiring extensive uprighting
- Lateral incisors that are blocked in lingual crossbite that will have too much torque as they move into normal position
- Case needing extensive Class III elastics - prevents loss of torque control resulting from elastic wear
- Extreme crowding cases combined with anterior tongue thrusting or thumb - finger habit
- Where extensive arch length needs to be gained and the incisors have near normal torque angulation
Damon Prescription

**U3 - Upper Cuspids**

0° Torque +6° Tip 0° Rotation
- The standard torque prescription selected when the cuspids are in good position or labially inclined

+7° Torque +6° Tip 0° Rotation
- Any cuspids needing coronal uprighting
- Most extraction cases requiring first bicuspid space closure - prevents the cuspids from tipping lingual during space closure and helps position the root in medullary bone and away from the cortical plate

**U4&5 - Upper First and Second Bicuspids**

-7° Torque +2° Tip 0° Rotation
- The standard torque prescription selected for all upper first and second bicuspids

**U6 - Upper First Molar**

-9° Torque 0° Tip 10° Rotation
- The standard torque prescription selected for all upper first molars

**U7 - Upper Second Molar**

-9° Torque 0° Tip 5° Rotation
- The standard torque prescription selected for all upper second molars - this accent bracket is designed for easy archwire insertion

**L1&2 - Lower Central and Lateral Incisors**

-1° Torque +2° Tip 0° Rotation
- The standard torque prescription selected for all lower central and lateral incisors with minimal requirements for treatment mechanics
- Most extraction cases to prevent loss of torque control when retracting anterior teeth

-6° Torque +2° Tip 0° Rotation
- Extreme crowding in the lower anterior segment
- Cases needing extensive Class II elastics - prevents loss of torque control resulting from elastic wear (mentalis and orbicularis oris muscles also aid in controlling torque of the lower anteriors)
- Any incisor locked lingual with labial root position
- Cases needing a Herbst attached to the archwire
Damon Prescription

L3 - Lower Cuspids
0° Torque +5° Tip 0° Rotation
• The standard torque prescription selected when the cuspids are in good position or labially inclined

+ 7° Torque +5° Tip 0° Rotation
• Any cuspid needing coronal uprighting
• Most extraction cases requiring first bicuspid space closure - prevents the cuspid crown from tipping lingual during space closure and helps position the root in medullary bone and away from the cortical plate

L4 - Lower First Bicuspid
-1 2° Torque +2° Tip 0° Rotation
• The standard torque prescription selected for all lower first bicuspids

L5 - Lower Second Bicuspid
-17° Torque +2° Tip 0° Rotation
• The standard torque prescription selected for all lower second bicuspids

L6 - Lower First Molar
-30° Torque +2° Tip 0° Rotation
• The standard torque prescription selected for all lower first molars

L7 - Lower Second Molar
-10° Torque 0° Tip 5° Rotation
• The standard torque prescription selected for all lower second molars (Second molars usually require uprighting - using -10° torque with 7° of tube and archwire play finishes the second molar at a net 17° to 18°)
Crowded Cases
Face-Driven Treatment Planning Utilizin
"Physiologically Adaptive Mechanics"

The following cases graphically demonstrate how facial treatment planning can and should be our primary focus. These patients are obviously very crowded. It is interesting to ask the question, "Why so crowded?" Are the bones of the mid-face and body of the mandible smaller than normal or has there been an adaptation of the alveolar process to abnormal muscle forces impacting arch development? Early in my career extractions would have been the treatment plan without hesitation. It is exciting to see that more orthodontists around the world are realizing the incredible impact our treatment decisions are having on the maturing profile.

Many orthodontists have been trained to evaluate the patients from head films only. With the improvement in technique and technology, patients can now be treatment planned evaluating the long-term implications on both profile (lateral view) and arch width and facial support (frontal view). It is so critical to design treatment mechanics that do not overpower the biological system.

In viewing these cases, please note that great care has been given to using treatment forces that are just high enough to stimulate cellular activity without overpowering the periodontium and orofacial muscular complex. If the optimal forces are maintained, the alveolar bone and tissue can be moved with teeth.

This physiologic adaptation is obviously a paradigm shift for most clinicians. The art of clinical orthodontics with the Damon System is to try to match treatment mechanics with the natural low-force systems of the body. The following clinical cases show how very simple mechanics and this low-force system can achieve results that are beneficial to patients, parents, clinicians and staffs.
M.J.

**Age:** 14 Years - 6 Months

**Diagnosis:** Class I Nonextraction - Youth (severe crowding, very flat profile)

**Background:**

Early in my career this patient would have been subjected to extractions without hesitation. Treatment decisions were based on headfilms and maintaining the original dental arch form. In following these cases long term, it became very apparent that there is a significant facial change with maturation. It is now well documented that there is tremendous nose and chin change into the late 20s and 30s. As these patients mature, many clinicians observed a tremendous dishing of facial profiles. When I started to challenge my thought process on treatment planning and its long-term facial impact, I asked the question, "Why are these patients so crowded?" Are the jaws smaller than normal or is there an imbalance of the orofacial musculature complex (see Bioadaptive response)? The treatment of this case illustrates very graphically what a significant role these muscle forces play in shaping arch form.

Orthodontists for many years have accepted the necessity of posterior arch change in early posterior crossbite cases (see Posterior expansion). This posterior arch change is usually fairly stable. Obviously the muscles have to adapt or these cases would never be stable. What is exciting about this new low-force technology used to treat this case is the positive impact it has on the alveolar bone and tissue. It appears that in most cases the patient is given a "second chance" to find a new balance of the orofacial muscular complex. Please observe the positive impact this low-force/low-friction treatment has had on this patient. The cuspsids were engaged with the first archwire to encourage anterior movement of the incisors. It is very exciting when Face-Driven Orthodontics and Treatment Planning can be accomplished in 1 4 months 2 weeks and 7 working appointments.
**Facial Evaluation:**
1. Concave facial profile.
2. Prominent nose and chin.
3. Lack of lateral facial support.

**Pretreatment Radiographic Survey:**

Lower third molars in poor position and extracted prior to treatment.

**Dentition Evaluation:**
1. Severe collapse of maxillary and mandibular arches.
2. Severe lack of arch length and width in maxilla and mandible.
3. Maxillary and mandibular incisors tipped lingually.
4. Retrognathic position of incisors relative to body of mandible.
5. Upper incisors overerupted.
6. High and labially blocked cuspids.
7. Minimal bone and tissue covering labial of upper and lower cuspid.
8. Extracted mandibular third molars prior to treatment due to poor position.
Treatment Objectives:
Goal: Critically evaluate and project treatment planning impact on the face of this patient at 30 years of age. All of his brothers and sisters have a very strong nose and chin. Treatment mechanics designed to allow anteriors to come forward, giving increased facial support.

1. Allow low-force mechanics to work with the orofacial muscle complex, bone and tissue to establish a new physiologic tooth position (see Physiologic adaptation) that allows the tongue to move into its normal position to counter the force of the facial muscles.
2. Gain maxillary and mandibular arch length.
3. Design treatment mechanics to eliminate need for high-force rapid palatal expansion.
4. Establish appropriate upper anterior tooth-to-lip relationship.
5. Establish improved bone, tissue, and vascular support around upper and lower cuspids.
6. Improve profile and lateral facial support.

Treatment Sequence:
Special torques in appliance construction.
- Upper central +7° and laterals +3° (low-torque brackets). These brackets were chosen to keep incisors upright during unraveling and help prevent flaring forward.
- Lower centrals and laterals -6° (low-torque brackets). These brackets were chosen to keep incisors upright during unraveling and help prevent flaring forward.

Start:
1. Bonded maxillary 7 to 7 and placed mandibular bite plate to open bite enough to let the upper lateral incisors move out of crossbite.
2. Due to clinical desire to move the upper anteriors forward, engaged the maxillary cuspids with .014 NiTi SE (see Initial arch wire).
3. Stop placed between left bicuspids, which limited ability to level and align maxillary arch. Should place crimpable stops anterior to cuspids (see Crimpable stops).
In this case the crimpable stop was placed posterior to the crowding, the wire from fully expressing itself. The crimpable stop should always interior to the crowding.

Appt. 1

2 months - 2 weeks:

- Continued to let maxillary .014 NiTi S.E. archwire work.
- Continued full-time wear of lower bite plate. Note: This is a rare occasion when compliance is necessary.

Appt. 2 5

months:

- Bonded mandibular arch 7 to 7.
- Placed maxillary .014 x .025 NiTi SE.
- Placed mandibular .014 NiTi SE.
- Note maintenance of Class I occlusion.
Appt. 3
7 months - 2 weeks:

Placed maxillary .016 x .025 NiTi SE and mandibular .014 x .025 NiTi SE (see Working phase archwire)
Crowding remains, allowing .014 x .025 NiTi SE to finish initial phase.
Bite opening vertically.

Appt. 4
9 months - 2 weeks:

Took Panorex. Evaluated root and bracket positioning. Changed defective bracket prior to archwire change.
Placed maxillary .019 x .025 SS preposted archwire (see Final archwire).
Crowding remains, allowing .014 x .025 NiTi SE to finish initial phase.
Bite opening vertically.
Appt. 5 12

months:

Placed mandibular .016 x .025 preposted stainless steel archwire. Since torque control was accomplished, it is very desirable to have play in bracket tube, which helps to close bite. Tiebacks are used to keep posterior spaces closed (see Tiebacks).

Adjusted maxillary archwire.
Continued bilateral V-elastics.
Started posterior box elastics (see Box elastics).

Appt. 6 13

months  2 weeks:

- Adjusted maxillary and mandibular archwire.
- Continued bilateral posterior V-elastics.
- Scheduled debonding.
Finals

14 months - 2 weeks: Debonded upper and lower.
Occlusal Cast Transverse Measurement Comparisons

Initial

Final
Retention:
1. Maxillary .016 x .022 Bond-a-Braid archwire bonded lateral to lateral.
2. Mandibular .026 stainless steel round bonded to all teeth cuspid to cuspid due to the severity of crowding.
3. Clear plastic overlay retainers made for upper and lower arches.
4. Damon splint to be worn nightly for first year.

M.J. Case Summary
MJ.

nitia

Fina

Note the incredible bone and tissue contours around the upper right and lower left cuspids that were initially blocked out of the arch.
T.S.

**Age:** 43 Years - 1 Month

**Diagnosis:** Class I Nonextraction - Adult (severe crowding, very flat profile with tissue-grafting indications)

**Background:**

This case is very similar to the previous case of a 14-year-old. It is an excellent case to show the similarities of treatment time, mechanics, and treatment response between youth and adult treated with the new System. Treatment time for the 14-year-old was 14 months 2 weeks with 7 appointments after bonding while the adult was 15 months 1 week with 8 appointments after bonding. It is also an excellent case to contrast the impact of conventional higher-force orthodontics vs. lower-force/lower-friction orthodontics. A significant portion of treatment time and mechanics in this case was spent in low force/hi-tech archwires.

It is easier to contrast these two in the following outline:

**Conventional High-Force Mechanics**
- Extraction of 4 teeth.
- Higher force mechanics.
- Estimated treatment time 22-24 months or more.

**Impact:**
- Negative effect on profile and facial support.
- Possible long-term adverse impact on periodontium.
- Longer treatment time and greater patient discomfort.

**Low-Force Mechanics**
- Nonextraction.
- Estimated treatment time 14-16 months (Actual 15 mos - 1 week).
- Low-force mechanics.

**Impact:**
- Very positive impact on profile and face.
- Positive impact on periodontium.
- Shorter treatment time and less patient discomfort.
- Exceeds patient's expectations for orthodontics.
Facial Evaluation:
1. Flat facial profile.
2. Prominent nose.
3. Lack of lateral facial support.
4. Thin lips.
5. Deep nasolabial folds.

Pretreatment
Radiographic Survey:

Dentition Evaluation:
1. Tendency toward Class III dentition with anterior crossbite.
2. Collapsed maxillary and mandibular arches.
3. Lack of arch length and width in maxilla and mandible.
4. End-to-end anterior occlusion - with incisal wear.
5. Compromised bone and tissue upper cuspids - will need connective-tissue grafts.
Treatment Objectives:

Goal:
Utilizing low-force mechanics - establish a new physiologic tooth position (see Physiological adaptation) balanced among the muscle of the face, tongue, bone and tissue.

1. Enhance facial profile.
2. Improve facial support.
3. Gain maxillary and mandibular arch length.
4. Establish good bone and vascular support (see Bioadaptive response) adjacent to upper cuspids prior to grafting.
5. Improve tongue position (see Tongue influence). Establish appropriate upper anterior tooth-to-lip relationship.

Treatment Sequence:

Special torques in appliance construction.
• Upper centrals +7° and laterals +3° (low-torque brackets). These brackets were chosen to keep incisors upright during unraveling and help prevent flaring forward.
• Lower central and lateral incisors -6° torque (low-torque brackets). These brackets were chosen to keep incisors upright during unraveling and help prevent flaring forward.
• Lower left cuspid +7° (high-torque brackets). This was chosen due to distal inclination. +7° will upright cuspid to net 0° position.
• Started with 1/2 bracket on upper laterals and lower right lateral.

Start:
1. Bonded maxillary and mandibular teeth 7 to 7.
2. Placed 1/2 bracket on upper lateral incisors and lower right lateral incisor, due to insufficient space for full-sized Damon brackets.
4. Tied 1/2 bracket lightly to archwire and spring.
5. Placed .014 NiTi SE (see Initial wire) in both arches. Note: Stops placed in anterior segment to permit full posterior expression of archwire during unraveling.
Appt. 1
2 months - 2 weeks:

- Removed springs and engaged brackets.

Appt. 2
4 months - 3 weeks:

Removed 1/2 bracket and placed Damon brackets on maxillary laterals and mandibular right lateral. Continued .014 NiTi.

Appt. 3
6 months - 1 week:

Rebonded upper left lateral and lower left second bicuspid. Placed maxillary and mandibular .014 x .025 NiTi SE. Note lateral expansion in bicuspid area. Note upper cuspids ready for grafting as bone contours and vascularity are established. Grafting delayed due to insurance.
Placed maxillary and mandibular .018 x .025 NiTi SE.

In crowded cases, an archwire sequence of .014 NiTi to .014 x .025 NiTi to .018 x .025 NiTi allows optimal force zone mechanics and allows passive insertion of stainless steel finishing archwire.

Let high-technology archwires and the orofacial muscle complex establish the arch form. Referred for connective tissue grafts upper cuspids.

It is important to establish healthy alveolar bone contours and blood supply prior to placing connective tissue grafts. Note bite opening to anterior open bite.

Appt. 5
11 months - 2 weeks:

• Placed .019 x .025 maxillary and mandibular preposted stainless steel archwires.
• Started full-time Class III elastics (see Class III elastics) with anterior trapezoid 5/16" 6 oz.

Class III and Anterior Trapezoid Elastics
Appt. 6 13 months:

- Adjusted maxillary and mandibular archwire. Tissue grafting performed.
- Continued Class III elastics with anterior trapezoid.
- Note anterior bite closing.

Appt. 7 14 months - 1 week:

- Adjusted maxillary and mandibular archwires.
- Continued same elastics.
Finals
15 months - 1 week: Debonded upper and lower.
**Occlusal Cast Transverse Measurement Comparisons**

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<th>Pretreatment</th>
<th>Posttreatment</th>
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<tr>
<td>35.0 mm</td>
<td>36.0 mm</td>
<td>26.0</td>
<td>26.5 mm .5</td>
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<td>1.0 mm change</td>
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Retention:
1. Maxillary .016 x .022 Braid-a-bond archwire bonded lateral to lateral.
2. Mandibular .026 steel round bonded to all teeth cuspid to cuspid due to the severity of crowding.
3. Clear plastic overlay retainers made for upper and lower arches.
4. Damon Splint made for night retention giving "activator" type of effect (see Retention).

.S. Case Summary
Hassan Hatem:
Age: 17 Years - 2 weeks
**Diagnosis:** Cl ass I Nonextraction - Youth (openbite with posterior crossbite - very narrow deep palate)

**Background:**
This case demonstrates that this new technology totally changes treatment planning. These types of cases were so challenging to treat with conventional mechanics. It is amazing to think of the high force systems I used to use, the discomfort I put patients through, and the kind of results achieved. It is exciting to think that such a challenging case can be treated in 18 months - 2 weeks in 11 total appointments with so little effort. Please observe the amazing palatal changes created by simply applying a force system that tries to mimic the natural force systems of the body. (Upper second bicuspids increased in width by 1.3 mm and the molars 1.1 mm with minimal tipping.) What is astounding is that these results are not age specific. Note these palatal changes are not just in the area of the teeth, but extend into the depth of the palate. This patient has a vertical growth pattern with obvious airway problems. The tongue position has significantly impacted his growth and development through lack of arch width, bilateral openbite, and impacting articulation of sound. Parents and patient were not concerned about the vertical maxillary excess. (No desire for surgical correction.) Father was treated with system in 11 months in spite of extensive crowding. He expressed great confidence in the system and was willing to accept the long lower face height. Note the health of the bone and tissue in spite of the significant changes in the width of the maxillary arch.
Facial Evaluation:
1. Strong vertical growth.
2. Long narrow face.
3. Lack of lateral facial support.
4. Very steep mandibular plane.
5. Airway problems.
7. Prominent nose.
8. Low tongue posture - lateral tongue thruster.

Pretreatment
Radiographic Survey:

Dentition Evaluation:
1. Bilateral posterior openbite.
2. Severe collapse of maxillary arch creating bilateral posterior crossbite.
3. Exceptionally deep narrow palate.
4. Moderate crowding of maxillary arch.
5. Upper incisors over-erupted.
6. Thin bone and tissue over upper and lower cuspids.
7. Watch third molars - extract when convenient for patient.

Note depth of palate.
Treatment Objectives:
Goal: With low-force treatment mechanics, try to establish a new balance of forces of the orofacial muscular complex. The key with this force system is NOT to overpower the biologic system. The closer the clinician comes to matching the force system of the body the more positive the impact on bone and tissue. Let the high-technology archwires work.

1. Design treatment mechanics to eliminate need for higher-force rapid palatal expansion.
2. Increase maxillary arch width.
3. Improve facial support.
4. Create a new balance of muscular forces by establishing a new "physiologic tooth position."
5. Create treatment impact airway and articulation of sound.

Treatment Sequence
Special Torques
• Low-torque +3° upper left lateral used to prevent uprighting.
• High-torque +7° lower left and right cuspids used to improve root position.

Start:
1. Bonded maxillary and mandibular arches 7 to 7. Placed 1/2 bracket on rotated lower left bicuspid.
2. Placed .014 NiTi SE in maxillary and mandibular arches.
3. Attached C-chain from left bicuspid to molar hook to correct severe rotation.
Appt. 1
2 months - 2 weeks:

- Rebonded lower right bicuspid.
- Replaced 1/2 bracket on lower left second bicuspid.
- Placed maxillary .014 x .025 NiTi SE - Desire to keep low force on upper arch; let the system work.
- Placed mandibular .016 NiTi SE due to rebonding of lower right second bicuspid.

Appt. 2 5 months:
- Rebonded lower left and right laterals and lower right first bicuspid.
- Placed maxillary .018 x .025 NiTi SE. Objective is to continue to let low-force high-tech archwires impact width of maxillary arch.
- Placed mandibular .014 x .025 NiTi SE.

Appt. 3
7 months 2 weeks:
- Took Panorex: Maxillary arch: Continue to let .018 x .025 NiTi SE work.
- Placed mandibular .018 x .025 NiTi SE.

Appt. 4
9 months - 3 weeks:
- Placed maxillary and mandibular .019 x .025 preposted SS archwire.

Appt. 5 12 months:
- Adjusted maxillary archwire, lightly expanded
- Began V-elastics full time.

Appt. 6 14 months - 2 weeks:
- Adjusted maxillary and mandibular archwires
- Continued V-elastics full time.
Appt. 7
15 months - 2 weeks:

- Adjusted maxillary and mandibular archwires.
- Began Class II elastics full time.
- Added V-elastics night time only.
- Add tiebacks to prevent space from opening.

Mid-treatment - 15 months - 2 weeks

Occlusal Cast Transverse Measurement Comparisons

Note: No transverse elastics or palatal expanders were used in this case.
Appt. 8 16 months - 2 weeks:

- Adjusted maxillary and mandibular archwires.
- Began bilateral V-elastics and box elastics worn on right side including upper and lower first and second molars. Both worn nighttime only.

Appt. 9 17 months - 2 weeks:

- Checked occlusion.
- Continued same elastics.
Finals

18 months - 2 weeks: Deband upper and lower.
Retention:

- Maxillary .016 x .022
- Hilgers braided wire bonded maxillary lateral to lateral.
- Mandibular .026 steel round bonded to cuspids.
- Splint made to orient the maxillary and mandibular arches at night and also to maintain the torque.
- Slip-cover retainers made for upper and lower arches - will eventually be worn when the splint is retiree
6 months retention

1 1 mm maxillary bicuspid width increase.
Evaluate positive bone and tissue response.
S.H.

Age: 15 Years-3 Months

**Diagnosis:** CI ass I Nonextraction - Severe crowding, very flat profile

**Background:**

This case was selected to illustrate the long-term impact of treatment planning on the face and the periodontal considerations resulting from extensive crowding. Treatment planning cases like this one can be extremely challenging. This patient has a very obtuse nasolabial angle and lack of lateral facial support. With maturation, it is well established that the severity of the flat profile magnifies. Realizing the long-term implications on the profile, nonextraction therapy has always been desired but questionable due to the periodontal impact on the lower arch.

With traditional mechanics, the lower incisors always severely tipped forward with an adverse impact on periodontium of the lower incisors. The periodontist who followed this case was astonished at how the bone and tissue responded to low-force/low friction therapy. Please carefully evaluate the close-up photographs of the anterior segments taken 10 months in retention. It is gratifying to be able to have a very positive impact on the face, the periodontium, and treat the case in 18 months 2 weeks with 10 appointments.
Facial Evaluation:
1. Obtuse nasolabial angle.
2. Prominent nose and chin.
3. Lack of lateral mid-face support.
4. Flat upper lip.
5. Concave profile.

Pretreatment
Radiographic Survey:

Dentition Evaluation:
1. Severe collapse of upper and lower arches.
2. Severe lack of arch length and width in the maxilla and mandible.
3. Upper right and lower left cuspids totally blocked labial
   Upper incisors over-erupted.
4. Minimal bone and tissue covering blocked-out cuspids.
5. Lower posterior teeth tipped lingually.
Treatment Objectives:
Goal: To improve patient’s facial support. Anticipate this profile as a fifty-year-old. This is the perfect example of Face Driven Treatment Planning (see Physiological adaptation). Design low-force treatment mechanics that will allow the orofacial muscles, bone, and tissue to influence where the teeth will move. Hopefully, the tongue will normalize its position as this new physiologic tooth position is established.

1. Gain maxillary and mandibular arch length.
2. Eliminate the need for traditional high-force rapid palatal expansion.
3. Improve the bone, tissue, and vascular support around the labially blocked cuspids.
4. Eliminate the dark corners of the smile.
5. Minimize concave facial profile and obtuse nasolabial angle.

Treatment Sequence:
Special torques in appliance construction.
- Lower right cuspid +7° (high torque) was selected to upright the lingually tipped lower right cuspid.

Start:
1. Bonded maxillary and mandibular 7 to 7, excluding the upper right cuspid and lower left cuspid.
2. Placed maxillary and mandibular.014 NiTi SE (see Initial archwire) and activated medium-light NiTi SE spring in the lower left cuspid area (see NiTi springs).
3. No spring was placed in the upper right cuspid area due to the deflection of the archwire resulting from the rotated lateral
Appt. 1
2 months:
• Rebonded lower right cuspid.
• Continued to let .014 NiTi SE archwire work in mandibular arch.
• Placed maxillary .016 NiTi SE with medium-light NiTi spring in upper right cuspid area (see NiTi springs).

Appt. 2
3 months - 1 week:
• Bonded upper right cuspid and lower left cuspid.
• Rebonded upper right lateral after most of the rotation corrected.
• Placed upper and lower .014 NiTi SE archwires.
• Note: Decrease in size of maxillary arch wire to accommodate maxillary right cuspid.

Appt. 3
6 months - 1 week:
• Placed maxillary .014 x .025 NiTi SE and mandibular .016 NiTi SE archwires.

Appt. 4
8 months - 3 weeks:
• Placed maxillary .016 x .025 NiTi SE.
• Repositioned lower right second bicuspid bracket.
• Continued with mandibular .016 NiTi SE archwire.

Appt. 5 11
months:
• Took Panorex to check root position and brackets.
• Placed maxillary .019 x .025 preposted stainless steel (see Final Archwire)
• Placed mandibular .014 x .025 NiTi SE.
• Note: Almost one full year of treatment before initiating any rectangular wire on mandibular arch.

Appt. 6 13
months:
• Placed mandibular .017 x .025 TMA with crimpable hooks.
• Placed tiebacks on maxillary and mandibular archwire (see Tiebacks).
• Started light Class III elastics with anterior trapezoid (see Class III elastics).
• Note: TAAA wire used for ease of closing open bite with anterior trapezoid elastics.
Appt. 7 15 months - 2 weeks:

- Adjusted maxillary and mandibular archwires.
- Continued Class III elastics with anterior trapezoid.

Class III Elastics with Anterior Trapezoid

Appt. 8
17 months - 2 weeks:

- Adjusted upper and lower archwires.
- Placed finishing elastics.
- Note: Anterior open bite closed. Now closing posterior open bite with finishing elastics.

Finishing Elastics
Finals
18 months - 2 weeks:
upper ana lower.

Pretreatment
Posttreatment
Pretreatment
Posttreatment

Note increased facial profile support.

Pretreatment
Posttreatment
Pretreatment
Posttreatment

Initial

Posttreatment
Posttreatment
Final
Occlusal Cast Transverse Measurement Comparisons

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<td>4 mm change</td>
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Composite
Retention:
1. Debanded upper and lower.
2. Bonded upper and lower retainer wires placed cuspid to cuspid due to severity of crowding and tongue habit.
3. Clear-plastic overlay retainers made for upper and lower arches.
4. Impression taken for Damon Splint absolutely critical to make splint for nighttime wear - helps contain the tongue and maintain orientation of the upper and lower arches.
10 Months Retention

Note the incredible bone and tissue contours around the upper right and lower left cuspids that were initially blocked out of the arch.
T.B.

**Age:** 32 Years - 9 Months

**Diagnosis:** Class I Nonextraction - Adult

(openbite with severe crowding, posterior crossbite, and very deep, narrow palate)

**Background:**

This adult patient illustrates new opportunities for face-driven treatment planning. With conventional treatment mechanics, there would have been no question that four first bicuspids would have been extracted. Along with airway problems, this patient was challenged by certain sounds of speech due to tongue posture and a very narrow palate.

This patient would not have accepted treatment if extractions were required. In this case, our treatment objectives were to apply a more biologically sensible force (see *Bioadaptive Response!*) and let the orofacial musculature, bone, and tissue establish a new physiologic tooth position (see Physiological adaptation). Evaluate the initial and final models that have been measured for width change. This treatment alternative is very exciting when compared to conventional force systems. I cannot think of another way to have such a positive impact on profile, lateral facial support, airway, bone, and tissue utilizing such simple mechanics in 18 months 2 weeks and 10 patient visits.
Facial Evaluation:
1. Vertical grower - narrow face.
2. Long lower face height.
3. Prominent nose.
4. Lack of lateral facial support.
5. Airway problems.
6. Minimal chin.
7. Tongue-thruster.

Pretreatment
Radiographic Survey:

Dentition Evaluation:
1. Anterior open bite.
2. Severe collapse of maxillary and mandibular arches.
3. Severe crowding - lower right cuspid totally blocked out of arch.
4. Tissue recession - may need grafting.
5. Very deep, narrow palate.
6. Watch third molars.
**Treatment Objectives:**

**Goal:**
With low-force/low-friction mechanics, let the orofacial musculature, bone, and tissue establish a new physiologic tooth position (*see Physiologic adaptation*) that allows more room for the tongue. With low-force/low-friction mechanics, let the orofacial musculature, bone, and tissue establish a new physiologic tooth position (*see Physiologic adaptation*) that allows more room for the tongue.

1. Orthodontic treatment will have a very positive impact on patient's facial profile (e.g., minimize prominence of the nose).
2. Increase maxillary posterior arch width (*see Posterior expansion*).
3. Close anterior open bite - improve tongue posture and function (*see Tongue influence*).
4. Have positive impact on periodontium.
5. Improve mid-face support with dentition width change.

**Treatment Sequence:**

Special torques in appliance construction.
- Upper laterals +3° (low torque) chosen to prevent laterals from flaring forward.
- Lower centrals and laterals incisors -6° (low torque). These brackets were chosen to keep lower incisors from flaring forward during unraveling.

**Start:**
1. Bonded maxillary and mandibular arches 7 to 7.
2. Used 1/2 bracket on lower right lateral incisor tied to archwire with medium-light NiTi coil spring activated the width of one bracket.
3. Placed .014 NiTi SE (*see Initial archwire*) in upper and lower arches. Crimpable stop (*see Crimpable stops*) would have been better positioned between the lower central incisors to permit the wire to fully express itself during unraveling.
Appt. 1  
2 months - 2 weeks:

Placed maxillary .014 x .025 NiTi SE archwire.  
Placed mandibular .016 NiTi SE. Did not change bracket on lower right lateral incisor due to mild tooth tenderness.

Appt. 2  
4 months - 3 weeks:

• Changed bracket on the lower right lateral incisor.  
• Rebonded lower laterals and cuspids.  
• Continued with maxillary .014 x .025 NiTi SE and mandibular .016 Ni

Appt. 3  
7 months:

Placed maxillary .018 x .025 NiTi SE.  
Placed mandibular .014 x .025 NiTi SE.  
Let the NiTi SE archwire work! Very important not to force archwires. The alveolar bone responds best to lighter forces (see Working phase).

Appt. 4  
9 months:

• Took Panorex.  
• Rebonded maxillary centrals.  
• Placed .019 x .025 preposted SS (see Final phase)  
• Continued with mandibular .014 x .025 NiTi SE.
Appt. 5
10 months -1 week:
• Saw patient sooner (only five-week interval). Wanted to start elastics.
• Maintained maxillary .019 x .025 preposted SS.
• Placed mandibular .017 x .025 TMA with crimpable hooks and lateral incisor torque in archwire (see Final Phase). Used .01 7 x .025 TMA for mild torque and play in bracket to enhance impact of elastics.
• Started bilateral tent elastics full time (see Elastics).

Appt. 6
12 months - 2 weeks:

• Adjusted mandibular .01 7 x .025 TMA archwire (see Finishing and Detailing phase). Note: Tiebacks.
• Continued Tent elastics full time.

Appt. 7 14 months - 2 weeks:
• Adjusted maxillary and mandibular archwires.
• Continued elastics full time.
• Note: upper and lower tiebacks (see Tiebacks)

Appt. 8
16 months - 2 weeks:

• Checked occlusion.
• Continued elastics.
• Scheduled debonding in 8 weeks
Finals
18 months - 2 weeks: Debonded upper and lower
Occlusal Cast Transverse Measurement Comparisons

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<thead>
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<td>48.0 mm</td>
<td>52.0 mm</td>
<td>41.0 mm</td>
<td>46.0 mm</td>
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2.5 mm change, 8 mm change, 4 mm change, 5 mm change
Retention:
1. Debanded upper and lower.
2. Bonded upper and lower retainer wires placed cuspid to cuspid. Bonding all teeth due to severity of crowding and tongue habit.
3. Made clear-plastic overlay retainers for upper and lower arches.
4. Impression taken for Damon Splint absolutely critical to make splint for nighttime wear - helps contain the tongue and maintain orientation of the upper and lower arches.
C.B.

Age: 13 Years - 6 months

xJia.gHOSiS: Class I Left, Class II Right - Youth (tooth-guidance case with severe crowding and unilateral crossbite) (Started late due to patient circumstances)

Background:

The following case is a beautiful example of how facial treatment planning should and can be our primary focus. Early in my career, this case would have been extracted without even thinking of the long-term impact on the profile. Today, it is very interesting to observe how aware many patients and parents are of the impact orthodontic care can have on the face. Patients' expectations for an outstanding final result has changed from just straight teeth to desiring a great smile along with improving the profile and facial appearance.

Through improvements in technique and technology, these expectations can be met in a reasonable amount of time with little patient discomfort. The clinician can now treatment plan, thinking of the long-term implications on both profile and face. It is interesting to follow the change in this patient's profile over several years. Think how different this 8-year-old profile and face would look had four bicuspids been removed. Given the opportunity, this case should have been started long before the cusps erupted through tissue. It is so critical to design treatment mechanics that do not overpower the biological system. This is why medium-light NiTi SE springs are only activated 1 to 2 times the width of a bracket. The combination of light activation and length of spring from lateral to molar gives a very gentle constant force. The treatment goal is to use the "lip bumper" effect of the orbicularis oris and mentalis muscles. These muscles are basically our headgear. Note the minimal change in lower incisor position on the composite headfilm tracings.

This patient illustrates so clearly how bone can be moved with teeth if the "optimal force" is maintained. Without high-force rapid palatal expansion the maxillary bicuspid width has increased by 1 1 mm and molar width 14 mm with minimal tipping. Our treatment goal is to place a very light biologic force and then get out of the way and let the orofacial muscle complex, bone, and tissue determine what is going to happen. This is obviously a paradigm shift for most clinicians. The following clinical photographs show how very simple mechanics and a low-force system can achieve an end result that is very heartwarming to patients and parents. What a thrill it was to have Cody's mother call the office and say, "You have created a monster smile, the phone just doesn't stop ringing."
Facial Evaluation:
1. Class I face with severe crowding.
2. Class II dental on right side.
3. Unilateral posterior crossbite.
4. Good nose and chin button.
5. Lack of facial support laterally - fronta view.
6. The nose and chin will change dramatically as the face matures.

Pretreatment Radiographic Survey:

Dentition Evaluation:
1. Severe lack of arch length and width in both arches.
2. Moderate overbite.
3. Cuspids totally blocked to labial in both arches with very thin bone and tissue.
4. Posterior crossbite in molar area.
5. Upper second bicuspid erupting toward palate.
7. Upper midline left of center.
**Treatment Objectives:**

Goal: To achieve facial balance and symmetry with a very positive impact on profile. In this case it is absolutely critical to evaluate where this profile will be at 30 years of age. Cody resembles his father, who is tall with a very strong nose and chin.

1. Gain maxillary and mandibular arch length.
2. Establish upper and lower incisor position to give lip support.
3. Establish maxillary and mandibular posterior arch width to support mid-face.
4. Establish ideal maxillary lip-to-tooth relationship.
5. Design treatment mechanics to eliminate need for higher force rapid palatal expansion.
6. With low-force mechanics to work with the orofacial muscle complex, bone, and tissue to establish a physiologic tooth position.

**Treatment Sequence:**

**Special Torques**

- Upper centrals +7°, laterals +3° (low torque).
- Lower centrals and laterals -6°.

**Start:**

1. Banded maxillary and mandibular first molars - bonded central and lateral incisors.
2. Due to alignment of maxillary teeth and interbracket distance, placed an .014 x .025 NiTi SE with medium-light NiTi springs activated 1.5 to 2 times the width of a bracket. It was necessary to gain space due to severe labial position of the cuspids.
3. Placed mandibular .014 NiTi SE sectional archwire - archwire too light to engage molars.

**Appt. 1**

*2 months - 1 week:

- Placed maxillary and mandibular .016 x .025 NiTi SE. Activated spring .5 width of bracket.
Appt. 2
4 months - 1 week:

• Check only.

Appt. 3
6 months - 1 week:
• Activated springs.

Appt. 4 8
months:

Placed maxillary and mandibular .019 x .025 SS.
Took Panorex to evaluate position of erupting permanent teeth.

Appt. 5
10 months - 2 weeks:
• Adjusted maxillary archwire.

Appt. 6 12 months - 2 weeks:
• Bonded maxillary cuspids and first and second bicuspids.
• Placed continuous .014 NiTi SE in maxillary arch.
Appt. 7
14 months - 3 weeks:
• Repositioned maxillary left lateral.
• Waiting on eruption of permanent teeth.

Patient gone for 6 months

Appt. 8 19 months - 3 weeks:
• Bonded mandibular cuspids and first and second bicuspids
• Placed continuous mandibular .014 NiTi SE.
• Placed maxillary .016 x .025 NiTi SE.

Appt. 9
22 months - 1 week:
• Placed maxillary .019 x .025 S.S. preposted.
• Placed mandibular .016 x .025 NiTi SE
• Took headfilm.

Appt. 10
24 months - 3 weeks:
• Took Panorex to evaluate root position.
• Adjusted maxillary archwire.

Appt. 11
26 months - 2 weeks:
• Bonded mandibular second molars.
• Placed .016 NiTi SE overlay to engage mandibular second molars.

Appt. 12 29 months:
• Bonded upper second molars.
• Placed maxillary .016 NiTi SE overlay.
• Placed crimpable hooks on .016 x .025 NiTi SE.
• Started full-time bilateral V-elastics and anterior trapezoid elastics.

Bilateral V-elastics with Anterior Trapezoid Appt.

13 30 months - 3 weeks:
• Adjusted maxillary .019 x .025 preposted archwire; placed mandibular .016 x .025 S.S. preposted. Desired play between archwire and bracket slot for settling.
• Continued bilateral V-elastics full time.

Appt. 14
32 months - 1 week:
• Adjusted maxillary and mandibular archwires.
• Continued V-elastics full time.
Finals

33 months - 2 weeks: Deband upper and lower
**Occlusal Cast Transverse Measurement Comparisons**

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<thead>
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<table>
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<th>Measurement</th>
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<td>44.5 mm</td>
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Composite
Retention:
1. Maxillary .016 x .022 Hilgers braided wire bonded upper lateral to latera
2. Mandibular .026 round SS bonded to cuspids.
3. Upper and lower slip-cover retainer made - Night wear only.
1 year in retention - note tissue and bone

2.5 years in retention - no nighttime retention for 19 months.
C.B.

mg

2.5 years retention

Initial Bonding

2.5 years retention
Clinicians around the world using the Damon System mention that they are extracting far fewer cases. There seems to be a growing awareness of the positive impact that Damon treatment planning has on the maturing profile. Even though this technology broadens the horizons of Face-Driven Orthodontics, it should be very clear that there is a time to extract. In a practice where the face drives the treatment plan, I extract in the following situations:

- In extreme midline discrepancies where there are no other treatment options.
- Setting up cases for surgery.
- To improve bone and tissue contours around extremely poorly positioned teeth without negatively impacting the patient’s facial profile.
- To meet anteroposterior occlusion requirement where other options have been eliminated.
- In severe bimaxillary protrusion cases where correcting severe crowding without extractions will have a negative effect on the profile.
- In extraction cases, it is strongly recommended to retract the anterior teeth "En masse" (see En masse). My research suggests that taking cuspids back independently can have a negative long-term impact on the bone surrounding the cuspids. After watching many periodontal surgeries on patients treated before this technology was available, it is apparent that it is important to move teeth in groups rather than isolating individual teeth. Perhaps it is a vascular issue. Further research needs to be done in this area.

This technology has a very significant impact on treatment planning very crowded bimaxillary protrusion cases. With the engagement of very light archwires in a passive self-ligating bracket, it is very exciting to watch the anterior crowded teeth unravel into the extraction sites with little or no negative impact on posterior anchorage. With reasonable lip competence, the orbicularis oris and mentalis muscles give a "lip bumper" effect on upper and lower incisors.

Saving the demand on posterior anchorage is a huge advantage in these cases and lessens the impact of patient compliance on the treatment outcome.

In extraction cases, it is recommended to place +7° brackets on the upper and lower cuspids. This helps prevent the lingual tipping of the clinical crowns as the extraction sites are closed. It is far easier to retract the anterior teeth if the cuspid root is positioned in medullary bone instead of dragging the apices of the root along the cortical plate. Space closure is accomplished with the distal end of the medium NiTi springs hooked over the end of the archwire distal to the first molars, and the mesial end slipped over the pre-soldered hook on the archwire. It is very important not to hook the closing springs to the second molars because this has a tendency to rapidly flare the second molars to the buccal.

In maximum anchorage retraction cases, it is recommended to ligate the first and second molars together while hooking the spring to the hook of the first molar.

Occasionally, a stainless steel Pletcher spring is used for space closure on challenging cases. It is very apparent that not actively seating the archwire into the base of the bracket slot is a significant advantage in space closure.
K.H.

**Age:** 1 1 Years - 7 months

**Diagnosis:** Class II, Division I Extraction - Youth (bimaxillary protrusive)

**Background:**

This case was selected to demonstrate how the face determines treatment planning and that there is a time to extract. This patient was severely deficient in the mandible along with petite features of the face. Her genetic growth potential was limited, with the father being 5' 4" and the mother 5' 1". Both parents have very refined features. The treatment plan was to place a Herbst appliance and see how it could impact the profile of this very slow growing patient *(see Flip-Lock Herbst).*

The Herbst was left in place for 18 months. Tomograms and head films were taken and traced showing an ANB change of 3°. Even though the chin position improved, this little girl was still very protrusive. It was a challenge for her to fit her lips over her teeth. In view of genetic potential of this patient and the refined features of her parents, this case was scheduled for four first bicuspoid-extractions.
Facial Evaluation:
1. Severely deficient mandible with severely protrusive maxilla.
2. Poor genetic growth potential (parents 5’ 4” and 5’ 1” tall).
3. Lack of lip seal (protrusive upper lip).
4. Disproportionate lower facial height.

Pretreatment Radiographic Survey:

Dentition Evaluation:
1. Class II molar relationship right side.
2. Generalized spacing in maxillary arch.
3. Upper incisors labially inclined.
4. Large central incisors.
5. Significant overjet.
Treatment Objectives:
Goal:
To achieve a Class I face - then reevaluate protrusion and profile. Desire to achieve facial balance and symmetry.

1. Anticipate treatment impact on patient's maturing profile.
2. Leave Herbst on at least 16 to 18 months due to severity of the Class II and the very petite size of the patient (slow growing).

Phase I - Herbst Treatment

Treatment Sequence:
• Fabricated Herbst (see Flip-Lock Herbst).
• Took tomograms prior to starting treatment.

Start
1. Advanced Herbst 4 to 4.5 mm. Do not advance again for at least 5 to 6 months.

Appt. 1
2 months - 2 weeks:
• Checked Herbst.

Appt. 25 months:
• Advanced Herbst 3 mm.

Appt. 3
7 months - 2 weeks:
• Checked Herbst.

Appt. 4 10 months - 2 weeks:
• Checked Herbst - added 1 mm shim.

Appt. 5 13 months:
• Checked Herbst.

Appt. 6 15 months:
• Checked Herbst.
• Took tomograms.
Appt. 7 18 months:

- Removed Herbst.
- Took progress records.
- Scheduled full bonding.

Pre-Herbst Treatment

Post-Herbst Treatment
Phase II - Post-Herbst Treatment

Treatment Sequence:
Special torques selected.
• Upper and lower cuspsids +7°. This cuspid prescription was used to prevent the lingual tipping of the clinical crowns.

Start
Patient waited 5 months before starting second phase of treatment
1. Upper and lower first bicuspids were extracted.
2. Bonded upper and lower arches 6 to 6 (second molars not erupted).
3. Placed .014 NiTi SE (see Initial archwire) on maxillary and mandibular arches.

Appt. 1
2 months - 2 weeks:
• Placed maxillary and mandibular .016 x .025 NiTi SE (see Working Archwire).

Appt. 2
5 months:

Note: Distal eyelet bent 90° prior to placing over distal end of cut archwire.

Placed maxillary and mandibular preposted .019 x .025 SS with NiTi closing springs hooked on archwire distal of the first molars. Do not attach springs to the hook of the second molars. It will flare the molars to the buccal (see Final Archwire and NiTi coil springs).
Appt. 3
7 months - 1 week:
• Activated NiTi springs (see NiTi coil springs).
• Clipped maxillary and mandibular .019 x .025 preposted archwires distal to first molars.
Maximum Anchorage: Note ligation

In minimum anchorage retraction cases, it is recommended to cut the archwire distal to the first molar and attach the spring to the distal end of the first molar tube.

In maximum anchorage retraction cases, it is recommended to ligate the first and second molars together while attaching the spring to the hook of the first molar.

Appt. 4
9 months - 3 weeks:
• Activated NiTi springs (see NiTi coil springs).
• Started Class II elastics (see Class II elastics).

Appt. 5 12 months:
• Bonded upper and lower second molars.
• Placed .016 NiTi SE overlay archwire (see Overlay archwire), allowing Class II elastic wear to continue with edgewise SS still in place. The .016 NiTi SE overlay wire allows the late-erupting second molars to be brought in line and at the same time maintains elastic use.
Appt. 6  
14 months - 2 weeks:
• Adjusted maxillary archwire.
• Continued Class II elastics (night only), including anterior trapezoid.

Appt. 7 16 months:
• Adjusted maxillary and mandibular archwires.
• Started nighttime V-elastics (see V-elastics) and anterior trapezoid elastics.

Appt. 8 17 months - 2 weeks:
• Adjusted maxillary archwire.
• Continued V-elastics and anterior trapezoid elastics full time.

Appt. 9 19 months:
• Adjusted maxillary and mandibular archwire.
• Continued V-elastics and anterior trapezoid elastics (see V-elastics and Anterior trapezoid elastics)

Appt. 10  
20 months - 2 weeks:
• Adjusted maxillary archwire.
• Continued V-elastics and anterior trapezoid elastics.
• Scheduled debonding.
Finals: 21 months - 2 weeks: Debonded upper and lower.
K.H. Post Herbst Case Summary

Maxillary

- .014 NiTi SE
- .016 x .025 NiTi SE
- .019 x .025 SS Preposted
- NiTi space-closing coil springs
- .016 Overlay NiTi SE

Class II Elastics

Mandibular

- .014 NiTi SE
- .016 x .025 NiTi SE
- .019 x .025 SS Preposted
- NiTi space-closing coil springs
- V and Anterior Terminating Elastics
- Add Anterior Terminating Elastics

Weeks
Retention:
1. Maxillary .016 x .022 Bond-a-Braid archwire bonded lateral to lateral.
2. Mandibular .026 steel round bonded to all teeth cuspid to cuspid due to the severity of crowding.
3. Clear-plastic overlay retainers made for upper and lower arches.
4. Damon Splint made for night retention to retain Class II correction. Splint to be worn for approximately one year, then changed to slip covers.
There Is A Time To Extract

Background:

The more that I have used this technology, it has become very apparent that the "Art of Low-Force Low-Friction Technology" is to be able to "Read and React" to how the orofacial musculature, bone, and tissue respond to this revolutionary force technology. This case has been selected to demonstrate how occasionally a case will respond quite differently than the previously shown crowded cases. This patient was treatment planned and started in a similar manner to the previous cases. (Please note that some of the previous cases also presented with a mild to moderate anterior tongue thrust.) The following clinical photographs very graphically demonstrate how the combined forces of the anterior tongue thrust and the light mechanical forces used to align the teeth simply were stronger than the counter-balancing forces of the orbicularis oris and mentalis muscles. These resultant forces produced a bimaxillary protrusive dentition with a significant openbite and very negative impact on the patient's facial profile. (This has not been observed often in the patient pool I have treated.) My recommendation would be early recognition of this muscle imbalance and the extraction of teeth in the light-wire phase (.014 CuNiTi) to minimize the round-tripping of the anterior segments that is observed in this case. I found it very interesting that after the first bicuspids were extracted, and without using any closing mechanics, the entire upper extraction space was nearly closed during the light-wire alignment phase after rebonding.

This case shows graphically the following:

1. Face-driven treatment planning.
2. Read and react to what the body gives the clinician.
3. There is a time to extract.
4. The tremendous impact that the orofacial musculature has on treatment outcome.
Initial:

Progress Records:
Progress records after aligning teeth
extract earlier - avoid round trippin

84
Panorex June 1, 2001 Note space closure with muscle forces only.
Occlusal Cast Transverse Measurement Comparisons

Note: Minimal lateral posterior development following bicuspid extractions.
Note healthy tissue even in extraction case.
This section is intended to share with clinicians some of the things I have learned after using the Herbst appliance for more than 24 years (see Flip-Lock Herbst). My comments are based on observations made after having the opportunity to treat over 2,800 cases and following many of these cases for years posttreatment. The exciting thing about orthodontics is that our clinical observations combined with the improvements in technology can impact how we use and apply any system on a daily basis. My intent is to give an overview on how this wonderful technology is utilized in treating some of our most challenging cases.

The Herbst is one of the most powerful treatment options we have in orthodontics. The combination of the new low-force/low-friction clinical system and the Herbst appliance gives the clinician the opportunity to convert very complex and long-term treatment situations into very straightforward, noncompliance mechanics with far better clinical results for the patient. After having the opportunity to lecture around the world, it has become very apparent that many clinicians have a very negative view of the Herbst appliance and its clinical application. Quite frankly, many of these comments are justified when discussions only center around the Herbst's impact on ANB. My observation is that there is a huge variable in what does or does not happen to ANB. My interest in using the Herbst appliance is focused far more on its functional impact on the whole orofacial complex rather than just focusing on ANB. Yes, it is nice when ANB responds positively, but in some cases, it simply does not change. Even though ANB may not be impacted, there are so many positive things that happen when the patient is given a second chance for the whole facial and dental complex to function in a more normal manner.

If the mandible is advanced slowly and over an extended period of time, the impact is very dramatic in both growing and nongrowing patients. We have all seen the narrowing of the upper arch in a severe Class II skeletal patient. This is an example of the "functional adaptation" of the alveolar process and dentition reacting to the patient's musculature that is altered by the anteroposterior position of the mandible. If this mandibular position is slowly normalized, it is amazing to observe how the teeth and alveolar process respond laterally even without orthodontic intervention.

Clinical Principles
We all know that the growth of young patients occurs over a very long period of time. It has always made logical sense to me that time is needed to give the body the chance to react to a given functional change. The old adage of "form follows function" is appropriate when using the Herbst. My favorite time to start Herbst treatment is when the young patient's growth starts to take off. (Some exceptions are very severe cases and those patients with self-esteem and special growth issues.) Average starting age for females is approximately 10.5 to 11 years, while boys are later at 11 to 11.5 years. I strongly recommend only advancing the Herbst 4 to 4.5 mm at the beginning of treatment. There are so many advantages to activating slowly and over a long period of time. I like the concept of not advancing the condyle more than 2/3 the way down the articular eminence. This small advancement of the mandible lessens the Class II elastic effect of the musculature and therefore minimizes the
“dumping” of the lower incisors. With this small advancement, I rely on the “functional effect” of the Herbst and muscles to naturally initiate lateral upper arch adaptation, negating the need for higher-force palatal expansion prior to placing the Herbst. As the mandible is advanced with the Herbst, the combined impact of the V-shape of the mandible and the Herbst rods allows a very slow and natural lateral change in the maxilla with very little dental tipping. What is interesting is this lateral adaptation of the palate is not age specific.

The second advancement of approximately 3 mm is done at 5 to 6 months into treatment. Once again, the activation is allowed a time interval of approximately 5 months for the muscles to adapt. Activations thereafter are done with the same principles applied to each patient’s specific needs for skeletal correction. In most cases, activation is stopped when the upper and lower anterior teeth are end to end. The average length of treatment is 14 to 16 months. (In very severe applications, that treatment time has been extended to 2 years or more.) If a patient tends to relapse during the full-bonded phase of treatment, I give the Herbst a second effort on the archwire. Some of the most successful cases I have treated have resulted from more than one application with the Herbst. Special retention for these Herbst cases is critically important (see Retention /Damon Splint).

In the following cases, please observe the length of time for a nightly splint to be worn following debonding. This “activator” type retainer is so important to the success of this type of treatment.

Summary
The powerful combination of the Herbst and high-technology clinical orthodontics allows the clinician to simplify treatment mechanics and convert our most challenging cases to routine clinical orthodontics. Advancing the Herbst slowly, letting it work for a long period of time, and retaining with a night splint are my key elements for success. Most of the Herbst research done to date has been done on patients that have been activated rapidly, treated over a much shorter period of time, and without anteroposterior retention. It is exciting when very special technologies can have such a profound benefit and impact for both the clinician and patient.

Clinical Applications
I use the Herbst in several different ways both in timing and treatment application.

- Mixed-dentition Herbst with and without anterior brackets
- Archwire Herbst application in patients with full dentition
- Archwire Herbst for TMJ patients
- Archwire Herbst with coil springs as supplement for Class II elastics
- Examples of these applications will be shown in the following cases.
K.P.

**Age:** 1 2 Years - 5 Months

**Diagnosis:** Class II, Division 1  Nonextraction - Youth  
(normal response to Phase I Herbst treatment)

**Background:**

This case was selected to demonstrate the average response to a standard type of Herbst treatment. In the initial profile photograph it is very apparent that the mandible is growing slower than the maxilla. In these types of Class II cases, I have never been comfortable trying to move the maxilla or dentition back to meet a deficient mandible. This traditional headgear approach left a significant number of patients with a prominent nose, lack of upper lip support, and a very weak chin. It has always made more sense to treatment plan these cases trying to create an environment for mandibular change rather than retraction of the maxilla or maxillary anterior teeth. Please observe the beautiful impact Herbst treatment has had on this patient's facial balance and dentition. As the full bonding phase of treatment is started, we are now treating a simple Class I with increased maxillary arch width, eliminating the need for high-force palatal expansion. It is interesting to note that on this patient the upper bicuspid width change was less than is normally observed with Herbst treatment. The tongue did not completely reposition itself until after full-bonded treatment was started. Note on the final models that the first bicuspids moved laterally 10.5 mm with minimal tipping. The combination of these technologies certainly simplified the treatment plan, minimizing the need of patient cooperation, with results very rewarding to the patient and clinician.
**Facial Evaluation:**
1. Retrusive mandible.
2. Narrow mid-face.
3. Moderate overeruption of upper anterior teeth.
4. Good chin button.
5. Excessive tissue under chin (poor throat angle).
6. Disproportionate lower facial height

**Pretreatment Radiographic Survey:**

**Dentition Evaluation:**
1. Narrowing of anterior maxillary arch, typical of Class II patients.
2. Flaring of upper incisors.
3. Moderate overeruption of lower incisors.
4. Third molars present.
5. Lingually inclined upper and lower cuspids.
Treatment Objectives:

Goal:
Achieve outstanding profile with facial balance and symmetry of nose, lips and chin. Create upper and lower posterior arch width to support mid-face with low-force mechanics.
1. Establish upper and lower incisor position to give natural lip-to-tooth relationship.
2. May positively impact airway.

Phase I - Herbst Treatment

Treatment Sequence:

Special torques in appliance construction.
- High-torque maxillary centrals +1 7° and laterals +1 2°. When using a Herbst appliance, there is a tendency to upright anterior teeth. In this case we chose +17° on the centrals and +1 2° on the laterals to keep the roots of the anterior teeth from uprighting too much.

Start
2. Placed sectional .014 NiTi SE archwire (see Sectional archwire) extending from maxillary right cuspid to maxillary left lateral incisor with the ends of the wire heat treated and bent for comfort. Leave enough room for the anterior teeth to align.
3. Activated Herbst 4.5 mm initially.

2 months - 3 weeks:
- Placed maxillary and mandibular .017 x .025 TMA with moderate intrusive bends anterior to molar tubes. This wire is inserted in tubes soldered to the first molar Herbst crowns.

Appt. 2 6 months:
- Placed maxillary and mandibular .019 x .025 TMA with moderate intrusive bends to intrude anterior teeth. This wire is inserted in the tubes of the first molar Herbst crown.
- Added 2 mm shims.

Appt. 3
8 months - 2 weeks: Adjusted maxillary archwire. Jed 1 mm shim.

Appt. 4 10 months - 3 weeks:
- Checked Herbst.
Appt. 5
13 months - 2 weeks:
• Took tomograms and evaluated.
• Scheduled Herbst removal.

Initial

Post-Herbst

Appt. 6 '6 months:
• Removed Herbst.
  Took progress
Phase II - Post-Herbst Treatment

Treatment Sequence:

- Selected special torques.
- Upper and lower cusps +7°. The cusps were si
toed in. The +7° on the cuspsids is to help upright the cuspsids.

Start:
1. Bonded maxillary and mandibular 7 to 7.
2. Placed continuous maxillary and mandibular .014 NiTi SE with crimpab( stops (see Initial phase/Crimpable stops).

Appt. 1

2 months - 2 weeks:
- Placed upper .016 x .025 NiTi SE (see Working phase).
- Placed lower .014 x .025 NiTi SE to stay in optimal force zone (see Biozone).
Appt. 2
4 months - 3 weeks:
• Took Panorex to evaluate root angulations and bracket positions.

Appt. 3
7 months - 2 weeks:
• Placed maxillary .019 x .025 preposted SS with tiebacks (see Final phase).
• Mandibular .016 x .025 preposted SS with tiebacks. This keeps play in the bracket tube to help eliminate binding. Helps to close the posterior occlusion when trying to close the bite vertically.
• Started bilateral V-elastics (see V-elastics).
Appt. 4
9 months - 3 weeks:

Adjusted upper and lower archwires.
Continued full-time V-elastics.
Added Class II elastics *night only* (see *Class II elastics*).

Appt. 5 12 months:
- Adjusted maxillary and mandibular archwires.
- Posterior occlusion hard to close due to tongue repositioning (*see Tongue influence*).

Appt. 6
13 months - 2 weeks:
- Checked occlusion.
- Continued elastics.

Appt. 7 15 months - 1 week:
- Adjusted maxillary and mandibular archwires.
- Continued elastics.
Finals

17 months: Debonded upper and lower
Occlusal Cast Transverse Measurement Comparisons

<table>
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Retention:
1. Maxillary .016 x .022 Bond-a-Braid archwire bonded lateral to lateral.
2. Mandibular .026 steel round bonded to all teeth cuspid to cuspid due to the severity of crowding.
3. Clear-plastic overlay retainers made for upper and lower arches.
4. Damon splint made for night retention, giving "activator" type of effect until patient is finished growing.
One year retention
Adult Class II

One of the biggest challenges in clinical orthodontics is how to treatment plan nongrowing Class II patients. So often clinicians are faced with treating adult Class II cases with significant overbite or overjet where the profile and lateral facial support will be greatly impacted by our treatment-planning decisions. Most adults seeking orthodontic treatment desire far more than just straight teeth. They are keenly aware what the aging process is doing to their bite and face. With this system the clinician now has many more opportunities to meet this challenge.

The following cases demonstrate how this new technology and Class II elastics can have a profound impact on the treatment of these types of cases if certain principles are followed. I have found that treating the alveolar bone with great respect by utilizing lower forces in every phase of treatment can totally change what can be accomplished. It has always been fascinating how often I hear the comment "impossible" when thinking of dental correction of a Class II with nothing more than the use of elastics.
T.B.-M.

Age: 40 Years-10 Months

**Diagnosis:** CI ass II, Division 2 Nonextraction - Adult (correction with Class II elastics)

**Background:**

This attractive 40-year-old patient is an example of what was mentioned in the Class II nongrowing introduction. This patient has a beautiful upper lip-to-nose relationship with a strong chin button. The lower lip is slightly everted due to the position of the anterior dentition. What a challenge these cases used to be when using conventional mechanics. Earlier in my career I would have tried to dis-talize the molars or extract upper first bicuspids. Both of these treatment options would have had a significant impact on the profile with loss of upper lip support. With this lower-force technology, the overbite and torque can be corrected with the selection of high-torque maxillary anterior brackets and using a maxillary reverse curve NiTi archwire with +20° of torque (see Reverse curve NiTi archwire). This saves so much time and allows the clinician to start Class II elastics as soon as .019 x .025 SS wire is placed in the upper arch (see Final phase archwire).

This stainless steel archwire is strongly recommended to maintain the vertical in the maxillary arch when pulling Class II elastics. It is so encouraging to correct a Class II molar and cuspid, eliminate crowding in both arches, and level the curve of Spee without severely dumping the lower incisors. In this case the lower incisors actually uprighted slightly with only minimal anterior bodily movement. Two very important tips are to always cut the lower archwire distal to the first molars prior to placing Class II elastics and instruct the patient to wear two elastics on each side when sleeping if they posture the mandible forward when wearing elastics. In some cases, the patient will position the jaw forward when sleeping and minimize the effect of elastic wear. It was very exciting to be able to exceed this patient's expectations for orthodontics by finishing in 18 months with 11 total appointments. Obviously, outstanding patient cooperation is required!
**Facial Evaluation:**
2. Slightly everted and full lower lip.
3. Nicely defined lower jaw and chin button that masked retrusive mandible.
4. When smiling, shows narrow maxillary mid-arch width.

**Pretreatment . Radiographic Survey:**

**Dentition Evaluation:**
1. Class II molar and cuspid with 100% overbite.
2. Upper and lower incisors overerupted.
3. Upper central incisors too upright and too long.
4. Moderate crowding of both arches.
5. Significant curve of Spee.
7. Congenitally missing lower left second bicuspid with retained left second primary molar.
8. Third molars were extracted prior to starting treatment.
9. Full porcelain crown maxillary right incisor and mandibular eight first molar.
Treatment Objectives:

Goal:
Complexity of treatment is to correct the Class II molar and cuspid, eliminate crowding, curve of Spee without further dumping of the lower incisors.

1. Facial considerations dictated treatment planning options.
2. Eliminated extraction of upper first bicuspsids due to negative impact on face.
3. Establish arch form to give lateral facial support.
4. Control torque of upper and lower anterior segments.

Treatment Sequence:

Special bracket torques

• In this case the patient was going to wear Class II elastics long term.
• I selected +1 7° on the upper centrals and +1 2° (high torque) on the upper laterals to prevent the centrals from uprighting too much.
• Lower incisors -6° (low torque) were chosen to keep lower incisors from flaring during extended Class II elastics wear.

Start:
1. Bonded maxillary and mandibular 7 to 7, except for broken-down lower left first molar. Decided to place band for support.
2. Made nighttime soft splint for lower arch.
3. Placed .014 NiTi SE (see Initio! archwire) maxillary archwire - sectional mandibular .014 NiTi SE archwire (see Sectional archwire) due to lower left first molar not bondable.
4. Banded full mandibular arch at next appointment.
Appt. 1
2 months - 2 weeks:
- Banded lower first molar.
- Placed maxillary .017 x .025 NiTi SE reverse curve with +20° torque (see Reverse curve archwire).
- Placed mandibular .016 NiTi SE.

Appt. 2 5 months:
- Maxillary .018 x .025 NiTi SE. This is used as a transitional wire between the .017 x .025 NiTi SE reverse curve and the .019 x .025 SS finishing archwire. Without this transitional wire, going from the reverse curve to the finishing archwire would be too uncomfortable for the patient. (The reverse curve with +20° torque placed last appointment worked to perfection. Sometimes an .019 x .025 reverse curve with torque is needed.)
- Placed mandibular .016 x .025 NiTi SE.

Appt. 3
7 months - 1 week:
- Placed maxillary and mandibular .019 x .025 preposted SS archwire (see Finishing archwire).
- Took Panorex.
- Started Class II elastics 5/16" 6 oz (see Class II elastics).
- Full-time wear. Clipped lower archwire distal to lower first molars. This is critically important to be able to correct Class II cases with elastics.

Appt. 4
9 months - 1 week:
- Continued Class II elastics. Two elastics on each side at bedtime only if patient postured mandible forward while sleeping.

Appt. 5
10 months - 3 weeks:
- Checked patient. Continued Class II elastics.

Appt. 6
12 months - 2 weeks:
- Adjusted maxillary archwire with tiebacks (see Tiebacks).
- Continued Class II elastics.
Appt. 7 14
months:
• Placed mandibular .014 x .025 NiTi SE with tiebacks. Used .014 x .025 NiTi SE to incorporate second molars.
  Left for one appointment.
• Continued Class II elastics.

Appt. 8
15 months - 2 weeks:
  Maintained maxillary .019 x .025 preposted stainless steel archwires.
  Placed mandibular .016 x .025 preposted SS., for desired play between the arch wire and the slot of the bracket to improve settling/finishing.
  Started V-elastics full time.
  Added Class II elastics at night only (see V-elastics and Class II elastics).

Appt. 9 17
months:
• Adjusted maxillary and mandibular archwires.
• Continued same elastic wear.
• Prepared to debond.
18 months - 1 week: bonded upper and lower.
Occlusal Cost Transverse Measurement Comparisons

Pretreatment

Posttreatment

Pretreatment

Posttreatment
Retention:
1. Bonded maxillary .016 x .022 Hilgers braided wire lateral to lateral.
2. Bonded maxillary .026 steel round to all teeth cuspid to cuspid.
3. Damon Splint must be worn nightly for 10-12 months. Length of time depends on case severity.
4. Made regular slip-cover retainers in addition to splint.
Helen H.

**Age:** 47 Years - 1 month

**Diagnosis:** CI ass II, Division 2 - Adult (subdivision with TMJ)

**Background:**

This patient came to my office in 1990 seeking orthodontic care. After carefully evaluating the extensive crowding, loss of bone and tissue, full Class II right side, and over-erupted lower incisors, it became very apparent that with conventional mechanics used at that time, four bicuspid needed to be extracted. I advised the patient not to go ahead with treatment due to the negative long-term impact on her face. I felt that treating with extractions would have further compromised her facial support. In 1997, after hearing about the new technology, this patient once again came to the office seeking orthodontic care. In the following photos, please evaluate the positive impact low-force orthodontics had on this case. To treat nonextraction while correcting the subdivision, leveling and crowding without adversely impacting lower incisor position is something that I did not feel could be accomplished with conventional, actively tied mechanics. This case was selected because retention records are available over three years after debonding. Evaluate how this case is holding up in retention and the impact of treatment on the periodontium.
**Facial Evaluation:**
1. Lack of lateral facial support.
2. Flat or straight facial profile.
3. Shallow nasolabial area.

**Pretreatment Radiographic Survey:**

**Dentition Evaluation:**
1. Upper central incisors tipped back.
2. Significant wear of upper incisors.
3. Lingual coronal tipping of upper and lower cuspids.
4. Over-eruption of lower anteriors.
5. Extensive crowding of lower arch.
6. Full Class II right side.
7. Flaring of upper lateral incisors.
8. Thin tissue and gingival recession in several areas - may need grafting.
9. Popping and TMJ discomfort in left joint.
Treatment Objectives:
Goal: Due to profile and lack of lateral facial support, I felt it was imperative to level and align the occlusion without extracting teeth.
1. Improve mid-face support to minimize depth of nasolabial fold.
2. Control torque and vertical (overbite) of upper and lower anterior teeth - could help TMJ.
3. Correct anteroposterior subdivision with Class II elastics.
4. Position upper central incisors in position for veneers due to extensive wear. (Patient elected not to do veneers after treatment completed).

Treatment Sequence:
Special Torques Preferable
• Upper central incisors +17°, cuspids +7° (high torque)
• Lower centrals and lateral incisors -6° (low torque).

Start:
Banded maxillary first and second molars.
Today this case would be started with bonding the upper arch only. Today only gold crowns are banded
Made a soft splint for the lower arch to be worn nightly for TMJ.
Placed maxillary .014 NiTi SE.
• Bonded rest of lower arch.
• Placed maxillary .016 NiTi SE. (Treating today I would have placed an upper .014 x .025 NiTi SE.)
• Placed mandibular .014 NiTi SE after bonding lower arch.

Appt. 2
5 months - 2 weeks:

Placed maxillary .016 x .025 NiTi SE. (Today, I would have followed the .014 x .025 with .018 x .025 NiTi SE. I will not make the jump from .014 x .025 to .019 x .025 SS. Force is too high.)
Placed mandibular .016 NiTiSE. A larger archwire could have been engaged but .016 was chosen to let alveolar process adapt, particularly in lower left first bicuspid area where bone and tissue is very thin.

Appt. 3
7 months - 3 weeks:
• Placed maxillary .019 x .025 preposted SS with tiebacks.
• Placed mandibular .014 x .025 NiTi SE.
Appt. 4 10 months:
- Placed mandibular .018 x .025 NiTi SE. Note: due to the thin bone and tissue, time was given to let high-technology archwires work and let the alveolar bone and tissue adapt to these lower forces.

Appt. 5
12 months - 2 weeks:
- Placed mandibular .019 x .025 preposted SS with tiebacks.
- Began Class II elastics, night only due to TMJ; if TMJ OK after 2 weeks - Full time
- Note mandibular archwire cut distal to first molar. Very important in correcting a Class II.

Appt. 6
14 months - 3 weeks:
- Continued full-time Class II elastics.
- Added light anterior trapezoid.
- Took Panorex to check root position.

Appt. 7
17 months - 2 weeks:
- Adjusted maxillary and mandibular archwire.
- Continued Class II elastics right side only, full time.

Appt. 8
18 months - 2 weeks:
- Adjusted maxillary archwire.
- Continued Class II elastics right side full time.
- Added left Class II elastics night only.

Appt. 9
19 months - 2 weeks:
- Adjusted maxillary archwire
- Placed mandibular .016 x .025 preposted SS with tiebacks to let case settle.
  - Note: Decreased rectangular wire size and lower arch as in T.B.-M. case to facilitate finishing.
- Night elastics only.

Appt. 10
20 months - 2 weeks
Finals

21 months - 2 weeks: Debonded upper and lower.
Retention:
- Bonded maxillary .016 x .025 braided Hilgers wire lateral to lateral.
- Bonded mandibular .026 round SS wire bonded cuspid to cuspid - all teeth bonded.
- Made upper and lower slip-cover retainers.
- Made Damon Splint for night wear only to maintain subdivision correction - very important!
3 years - 2 months in retention After one year of wearing splint, gradually changed to slip-cover retainers. Note minimal change of lower incisor position after leveling and aligning with considerable Class II elastic wear. Evaluated positive impact on periodontium.
This section on elastic wear was compiled because so many clinicians wanted more information on how elastics were being worn in a passive self-ligating environment. We all know there are many different ways to achieve clinical results. An attempt has been made to keep treatment mechanics very simple. The following represents the elastics used on a daily basis in the clinic. It is exciting to see what can be achieved with elastic wear if the mechanical system is not bound up and if the forces used are biologically sensible.

Philosophy for Elastics

- Use posts on arch wires to distribute force evenly over all teeth.
- Gentle force is respectful of tissue.
- Eliminating bracket hooks keeps appliance clean and promotes healthy tissue.
  Remember the tie-wings are free to receive elastics.
Examples of Interarch Elastics

Bilateral Class II Elastics
Objective: Correct Class II Anteroposterior Dental Relationships

Class II Elastics with Anterior Trapezoid
Objective: Correct Class II Anteroposterior Dental Relationships and Anterior Openbite

5/16" 6 oz Moose Elastics
Examples of Interarch Elastics

Class II Elastics with Anterior Cross Elastics
Objective: Correct Class II Anteroposterior Dental Relationships with Anterior Midline Discrepancy

V Posterior Elastics with Anterior Cross Elastics
Objective: Correct Posterior Openbite with Anterior Midline Discrepancy

V Posterior Elastics
Objective: Correct Posterior Openbite
Examples of Interarch Elastics

V Posterior Elastics with Anterior Trapezoid
Objective: Correct Anterior and Posterior Openbite

Class III Elastics
Objective: Correct Class III Anteroposterior Discrepancies
Examples of Interarch Elastics

Class III Elastics with Anterior Trapezoid
Objective: Correct Class III Anteroposterior Discrepancy with Anterior Openbite

5/16" 6 oz Moose Elastics

Tent Elastics
Objective: Correct Openbite in a Specific Area

5/16" 6 oz Moose Elastics

Finishing Elastics
Objective: Finish a Case with a Challenging Bite to Close

Note maxillary tieback to maintain posterior space closure.

Note sectional mandibular archwire cut and removed distal to mandibular cuspid.
Examples of Interarch Elastics

Finishing Elastics with Anterior Trapezoid

Box Elastics
Objective: Correct Posterior Openbite in Molar Area.

Upper and lower archwire sectioned and removed in molar area.

Lower archwire sectioned between molars.
Bracket Placement

(See Bond Position)

Maxillary

U-1  4.75  mm
U-2  4.50  mm
U-3  5.00  mm
U-4  4.50  mm
U-5  4.25  mm

Mandibular

L-1  4.75  mm
L-2  4.50  mm
L-3  5.00  mm
L-4  4.50  mm
L-5  4.25  mm

All measurements are from the incisal edge of the tooth to the center of the archwire slot.

Placement Tips

• Upper brackets open incisally and lower brackets open gingivally.
• Focus on the mesiodistal ends of the pad and the mesiodistal edges of the tooth. The reduced size of the bracket and slide assembly allows you to visualize more of the pad.
• Check the Panorex for proper root position prior to bracket placement. Place the Damon appliance at the same height position as a traditional bracket system, or refer to the recommended measurements above.
• Place appliance using the crown-long axis and bracket scribe line.
• Ensure that the internal slot and horizontal components of the bracket are parallel with the desired occlusal plane. This is especially important while placing the lower anteriors.
• Use a mouth mirror to aid placement. The Damon brackets can be bonded directly or indirectly.
Opening/Closing Techniques

Pliers:
- When opening and closing the bracket, position the plier at a 60° angle in the direction the slide is traveling.
- The slide travels 1 mm and requires less than 5 1/2 lbs of force to open and close, eliminating the need for excessive pressure while operating.

Tweezers:
- Place your fingers near the tip of the tweezer for easier manipulation.
- When operating the tweezers, keep the instrument perpendicular to the bracket face (a 90° angle to the face of the slide).
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Active Appliance
Any orthodontic mechanical system wherein the archwire is seated totally against the base of the bracket. The combination of the archwire being seated against the base of the slot and the force being applied to the archwire increases binding and friction, which requires a higher force to move teeth along the archwire.

A-lastic
Urethane modules previously employed in active appliances to hold the archwire in place within the confines of the bracket. Typically, the A-lastics are changed at every orthodontic visit, increasing the chairtime at each appointment. Their binding force adds friction to the system, requiring a higher force to move teeth. The rapid fatigue of the A-lastics can cause loss of rotational control of teeth requiring re-straightening of the teeth following major mechanics. A-lastics may discolor and can present challenges associated with oral hygiene.

Active self-ligating brackets
A self-ligating form of an active appliance. The bracket contains a metal clip which is its own ligating mechanism. While no A-lastics are typically employed with this system, the active clip binds the archwire into the base of the bracket, effectively reducing the lumen of the slot. All of the same problems associated with tooth movement with the A-lastics systems are found in many phases of treatment using active self-ligating brackets.

Anterior trapezoid elastics
Elastic bands used to close anterior open bites and settle final anterior occlusion and guidance. The elastics are 5/16 inch and 6 oz force. They are placed over the maxillary central incisors and to the Class III hook positioned between the laterals and cuspids on the lower archwire.

Appointment intervals
Time span between orthodontic office visits which allow for biological repair processes to occur. The longer appointment interval minimizes discomfort to the patient and actually allows the teeth to move at a more rapid, yet biologically sound rate. The passive self-ligating bracket appointment interval is usually ten weeks in duration during the early phases of treatment.

Bioadaptive response
Bio implies working in conjunction with sound biological principles. Adaptive indicates the use of treatment mechanics which allow the clinician to assist the body in adapting the individual's physiologically determined tooth position and arch form. Bioadaptive treatment mechanics use extremely light forces that work with the orofacial complex - the muscles of the face, tongue, bones and tissue - to allow the body to reestablish a natural balance.

Biozone or Optimal force zone
The level of forces which are high enough to stimulate cellular activity without completely occluding blood vessels in the periodontal membrane. One must apply a force strong enough to stimulate cellular activity without adversely affecting the vascular or oxygen supply in order to maximize the potential for tooth movement in an orthodontic delivery system.
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Bond enhancer
A coating applied to a tooth during the bonding procedure after the teeth have been conditioned, but before the brackets are placed, in order to improve the bond of the bracket to the tooth. The product is Ortho Solo (by Ormco) and is applied immediately before the placement of the brackets. It is lightly applied with a brush (less is more) and is not light cured before bracket placement.

Bond positions
Critical placement of the bonds in the Damon System are essential for success in treatment. Refer to the bracket-positioning guide chart for specific heights. When placing the brackets, care must be given to place the mesial and distal outline of the pad in the long axis of the tooth rather than aligning the body of the bracket. The continuous archwire slot and incisal edge of the pad are placed parallel to occlusal plane. Care must be given to place the upper and lower cuspid brackets at the height of contour which tends to be toward the mesial 1/3 of the clinical crown.

Box elastics
Elastic bands incorporated into treatment to close posterior lateral bites and settle posterior occlusion. These are utilized in the final arch wire phase. The elastics are 5/16 inch and 6 oz of force. They are placed over the hooks of the upper and lower first and second molars.

Bracket profile
The distance a bracket protrudes labially when bonded to a tooth. Damon brackets have been carefully designed to make it a true straight-wire System. The upper and lower brackets have been designed to open down or away from the clinician seating behind the patient. This allows for greater visibility into the archwire slot to check archwire placement prior to closing the door. This feature also allows the lower brackets to be designed with a lower profile above the archwire slot, lessening the chance of occlusal interference and bond failures. The interbracket distance and in-out position of the archwire enhances self-cleaning and minimizes decalcification.

Class II elastics
Extend from the anterior hook on the maxillary posted archwire, typically mesial to the maxillary canine, to the hook on the mandibular first molar. Rarely are they extended to the second molars. Sizes are 5/16 inch 6 oz force for nonextraction cases and 1/4 inch 6 oz force in four-bicuspid extraction cases. If the patient postures the mandible forward while sleeping, two elastics per side are recommended.

Class III elastics
Extend from the hook on the mandibular posted archwire, typically mesial to the mandibular canine, to the hook on the maxillary first molar. Rarely do they extend to the maxillary second molar. Sizes are 5/16 inch 6 oz force for nonextraction cases and 1/4 inch 6 oz force for four-bicuspid extraction cases. The archwire is typically cut between the upper first and second molar to facilitate movement.

Conventional brackets
The system of brackets that have historically been used for decades in orthodontic care delivery which actively ties the archwire into
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the slot with A-bstic or steel ligature ties. Much like active self-ligation, the resultant friction and binding require higher forces to move teeth along the archwire in most phases of treatment.

Crimpable stops
Small tubes or one open-side tube crimped on either side of an anterior bracket to prevent archwires from sliding side to side, causing a wire to poke out of the posterior tubes of the molars. The stops should always be placed anterior to the crowding on either side of a single bracket in an area where there is the least rotational deflection of the archwire. Some clinicians use light-cured composite (Revolution by Kerr) applied to the archwire on either side of a bracket to prevent the archwire from traveling.

Efficiency of movement
Teeth move more efficiently if the force levels are not frequently interrupted. Activation of an appliance too frequently "short-cycles" the repair process which would have been prevented by a longer appointment cycle. The Damon System is designed to take advantage of longer appointment intervals and lower forces which allow for a more biologically efficient and effective delivery of care.

En-masse retraction
Method of space closure whereby the six anterior teeth are ligated together and moved as a unit closing the extraction site. The anterior space is first consolidated via elastic C-chains (under the archwire if large spaces) on an .016 x .025 or .014 x .025 CuNiTi or NiTi SE archwires. After anterior space closure, this segment is ligated from cuspid to cuspid with .008 stainless steel ligature wire behind the archwire to prevent anterior spaces from opening. Posterior spaces are closed utilizing NiTi coils or Pletcher stainless steel coils on a preposted .019 x .025 stainless steel archwire. The coil springs are placed over the end of the archwire cut distal to the first molar while the other end is activated with ligature wire to the hook on the archwire placed mesial to the cuspids.

Extraction mechanics
The orbicularis oris and mentalis muscles maintain the AP (anteroposterior) position of the anterior teeth while the crowding seeks the path of least resistance, which is into the extraction sites. This is a very significant mechanical advantage since the crowding is alleviated without any demand on posterior anchorage. Taking advantage of these mechanics eliminates need for individual cuspid retraction. Moving the anterior teeth en masse appears to have a positive long-term periodontal impact, particularly around the cuspids.

Finishing and detailing phase
The last phase of treatment. All leveling, aligning, crowding, bite opening, space management and rotations have been completed. Final torquing and detailing are completed during this period of treatment. If minimal detailing is required, the working archwire .019 x .025 stainless steel is utilized. TMA is recommended if major detailing is required.
Final archwire
An .019 x .025 preposted wire manufactured of either stainless steel or TMA. If minimal bending and detailing is required, the "major mechanics archwire" is left in to finish. If moderate or greater bending and detailing is required, .019 x .025 TMA is recommended.

Flip-lock Herbst
Method of Class II correction utilizing the Herbst philosophy of treatment. Round pivots are welded to maxillary stainless crowns and to a cantilevered lower arm extending anterior from the crowns placed on the lower first molars. The lower stainless steel crown/lingual arch/cantilever is cemented with Fuji Glass cement. The maxillary crowns are cemented with Ormco Gold Powder in case of severe trauma to the patient. The tube and shields are "flipped" onto the round pivots of the maxillary crowns. Rods are inserted into the tubes and then coupled to the lower pivots on the cantilever. If necessary, shims can be added for accurate mandibular positioning.

The advantages of the Flip-Lock Herbst are increased comfort and the shield effect similar to that gained with a Frankel appliance. They act to keep the buccal musculature away from the teeth via the appliance, which allows for a more physiologic lateral development of the dental arches. The firmness of the rods prevents the "bowing" of maxillary molars typically associated with "add-on" mandible advancing appliances.

Initial advancement of 4 to 4.5 mm is designed into the appliance via a wax bite that aids in mounting the construction models on a simple articulator. Incremental advancements are made every 5 to 6 months and are not greater than 3 mm in length. The mandible is advanced to an edge-to-edge relationship and retained with a Damon Splint until ready for full fixed appliances. The mixed dentition is often blocked out in areas of erupting permanent teeth. The average length of Herbst treatment is 14 to 16 months. A tomogram is taken to confirm condylar position prior to Herbst removal.

Friction per bracket
The force required to pull an archwire through one bracket. This friction or binding diminishes the efficiency of orthodontic delivery systems to provide the most advantageous tooth movement over time. Conventional brackets tied with A-lastics produce 500 to 600 times more friction than passive self-ligating brackets (PSLBs). Those tied with stainless steel ligature ties showed approximately 400 times more friction than PSLBs. Active self-ligating brackets exhibited 216 times more friction than passive SLBs. (VoudourisJC, AJO 1997, Vol III, No 2)

Hi-tech archwires
Those modern archwires made of alloys other than stainless steel that exhibit low deformation and high-elasticity properties. The Damon System utilizes nickel-titanium (NiTi) archwires, copper nickel titanium archwires (Copper NiTi), and titanium molybdenum archwires (TAAA) to effect tooth movement. Wire progression and sizes are referenced in the archwire sequencing section of this workbook.
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Hi-tech edgewise phase
This phase is the "heart and soul" of the System. This phase starts working on torque, root angulations, levels, completes rotation control, arch form, consolidates space in the anterior segments, and prepares for the third phase of archwire sequencing. It is critically important to take a Panorex and evaluate root and bracket position before proceeding to the major mechanics phase of treatment.

Initial archwire
The first wire placed in treatment. Typically .014 CuNiTi (specially designed for the Damon System) is used to initiate alignment, leveling, start rotational control and bite opening and prepare for the next archwire. The Damon System advocates using light archwires early in treatment for as long as possible. It is advised to resist the temptation to place the largest archwire the clinician "can get in" because of increased binding, friction, and higher force. If forces are applied out of the "optimal force zone," the impact on bone and tissue is altered. These initial archwires can be entire arch or sectional in nature and are left in to be evaluated at ten-week intervals. One or two ten-week intervals are a normal duration for this initial archwire, depending upon severity of the original occlusion.

Initial light round archwire phase
The first light, round wire is carefully selected to minimize binding between the "tube" of the bracket and the archwire. This allows sliding of the teeth and brackets along the archwire as they start to level and align. The intent of the initial light, round archwires is to apply just enough force to stimulate cellular activity without crushing the vascular supply in the periodontium. The intent of this archwire is not to remove all of the rotations but to align teeth and bracket slots just enough to move to the second phase of the archwire progression. This initial .014 CuNiTi archwire is designed specifically for this system and has more resiliency than conventional .014 CuNiTi archwires. This phase of treatment generally extends for the first 10-20 weeks of treatment.

Interbracket distance
A defined measurement of space from the distal of one bracket to the mesial of the next. The Damon System has an interbracket distance that is extremely positive in terms of promoting favorable tooth movement and rotational control. The combination of interbracket distance, large lumen of the slot, and small-dimension round archwires lowers the applied force, particularly in the lower anterior segment.

Lumen
The aperture in a closed bracket that allows an archwire to pass through it. Three walls of a lumen are created by the base and two sides of the archwire slot in the bracket. The final wall is created by the closed slide in the Damon bracket, the wire tie (A-lastic or steel ligature tie) in a conventional bracket or the clip in an active self-ligating bracket. A small wire in a large lumen is most favorable for tooth movement as it diminishes the divergence of the angles in the archwire slot, which allows freer, less friction-laden movement.
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Major mechanics phase
The working portion or the third phase of archwire sequencing. This includes posterior space closure, anteroposterior dental correction (interarch elastics or Herbst application to the archwire), and adjusting buccolingual arch discrepancies. Stainless steel archwires are primarily used to maintain vertical and buccolingual control during this major mechanical phase of treatment. With low-friction brackets, lighter archwires are not recommended for this working phase of treatment.

MIM - Metal Injection Molding
The process by which the Damon brackets are manufactured. It is the most precise technology available today to manufacture metal brackets. This process is needed to manufacture exceedingly small accurate parts that will allow movement of the slide and very close tolerances of the archwire slot.

NiTi coils - Nickel titanium coil springs
Small segments of wound NiTi wire used for space opening or closing. The closed NiTi coils for space closure are manufactured with small eyelets on each end that allow one eyelet to be inserted over the end of the .019 x .025 SS posted wire clipped distal to the first molar. This eyelet is bent at 90 degrees to minimize friction and binding. The other eyelet is tied with ligature to the soldered hook on the archwire between the lateral and cuspid. Where maximum anchorage is needed, the first and second molars are tied together for greater anchorage and the NiTi coils are placed from the hook on the first molar and tied with ligature wire to the hook on the archwire anterior to the cuspid. The coil spring force needed in this maximum anchorage situation is greater and Pletcher stainless steel springs are recommended. The coils are generally 9 mm (medium strength) for extraction cases and 12 mm (medium strength) in nonextraction cases.

The open medium-light NiTi coils used for space opening are manufactured in straight lengths, or on a spool, and are cut to the appropriate lengths, which are 1 1/2 bracket-lengths longer than the distance from the distal of the anterior bracket to the mesial of the posterior bracket or tube. They are then compressed between the two aforementioned brackets and left to exert their force to increase the arch length. Crimpable stops are generally added to the archwire on either side of an anterior bracket to prevent the archwire from slipping. Occasionally, in a very long span, the archwire may be left slightly longer (and cinched if necessary) to prevent it from being dislodged from the tube or longer tubes can be incorporated on the molar tubes.

Opportunity mechanics
Theory of treatment planning employing those mechanics which are most appropriate for a given case at a given time. The operator does not do the same thing for every patient but rather observes a clinical situation and utilizes those techniques that will take advantage of the particular biological environment available. Forces remain in the Biozone. Treatment continues favorably as the biology of the patient is working with the clinician rather than in spite of it.
Overlay archwire
Any high-tech archwire lightly tied over the labial and buccal surface of closed Damon brackets of the arch extending from first molar to molar. This overlay archwire then extends into tubes bonded on the second molars. It is used in situations where the clinician desires to align the erupting second molars while continuing to detail and finish. In these situations the cases are near completion so little movement generally needs to take place other than the alignment of the second molars. Any frictional impact of the steel ties is minimal.

Passive self-ligating brackets
The design of brackets utilized in the Damon System. These low-profile brackets are characterized by the absence of the need of auxiliary A-lastics and steel ties (as in conventional brackets) or clips within the brackets (as in active self-ligating brackets) to hold the archwire in place. The archwire in a passive self-ligating bracket is held in place by a labial sliding mechanism. The archwire is, therefore, not bound against the base of the bracket and friction is minimized. The lumen of the slot is effectively larger, allowing the archwire to freely correct rotations as well as level and align well within the biological limits. The resultant effect is to provide greater movement with less force applied. By taking advantage of this unique feature, the goal is to apply biologic forces to the teeth that do not negatively impact the vascular supply in the periodontal membrane. In conventional or active self-ligating bracket systems, the resultant binding and friction forces the clinician to use higher forces, which make it more challenging to stay in the Biozone or Optimal Force Zone. By not needing to routinely change bracket ties, appointment intervals can be safely expanded.

Pletcher coils
A stainless steel (as opposed to NiTi) coil used for space closure. They are attached to the mesial hook of the posted .019 x .025 archwire and extended distal to the first molar. These deliver a greater force than NiTi coils and are typically used in adult cases as well as those cases where the space desired to be closed has been evident for long periods of time (previous extraction spaces). All other mechanics are identical for space closure.

Physiological adaptation
Taking for "Use what the body gives you to work with." The Damon light-force System allows the evident forces to dictate the ideal physiological arch form. By balancing the forces of the lips, cheeks, facial muscles, alveolar and skeletal bone, tongue, periodontal membrane and tooth morphology, the operator can retreat from those mechanics that are artificially influenced. Posterior expansion can be achieved without the use of mechanical expanders by adapting these forces, as can leveling, aligning and bite opening. By not overpowering the biomechanical system, the body's own physiology sets the course to a more biologically adaptive and biologically normalized result that is patient specific.

Posted archwire
These are used during the major mechanics and finishing phases of archwire sequencing (see Archwire sequencing). These are .019 x .025 in size and are manufactured of either
stainless steel or TMA. The posts can come prewelded from the manufacturer or can be crimped on mesial to the cuspid by the operator. The posts are used for space closure with coils springs, for space maintenance following space closure using tieback modules, and for interarch elastics.

**Posterior expansion or adaptation**
The impact of the orofacial muscles on alignment and arch development. By balancing these forces, the expansion of the arch is of a posterior nature that alleviates crowding through a balance of the delivery system, blood supply and muscles. This phenomenon allows the operator to treat nonextraction cases without the flaring of anterior teeth or forcing these anterior teeth through the cortical bone as previously associated with aggressive nonextraction techniques. Anteroposterior positions of the anterior teeth stay stable while a noticeable and measurable posterior adaptation of the buccal segments. This phenomenon is very similar to the observed "Frankel effect" generated by the Frankel appliance. (These adaptive changes have been shown to be as stable as other types of treatment involving extraction therapy.) The clinical impact of this routine clinical observation allows for far more cases being treated with Face-Driven Treatment Planning.

**Retention**
Basically three types.

1. **Maxillary:**
An .016 x .022 Bond-a-Braid (Reliance) wire is bonded to the palatal surface of the four maxillary anterior teeth using Revolution (Kerr).

2. **Mandibular:**
An .026 round stainless steel wire adapted to the lingual surface of the six mandibular anterior teeth is bonded using Transbond (Unitek). A "landing pad" of composite is injected onto the teeth and the .026 steel wire is inserted into the pad of composite on the teeth. Once cured, a layer of Revolution (Kerr) is injected around the wire and the pad, forming a "ski jump" contour or additional bond security and food deflection.

3. **Interarch retention:**
The Damon Splint/retentive splint - typically used following Herbst to hold the jaws in position while waiting for the full fixed-appliance phase. It is also used in cases with severe posterior crossbites, lateral tongue thrusts, severe Class IIIs corrected with elastics or a Herbst with springs, or any patient with severe muscle dysfunction (Buccolingual coordination challenges). It is constructed of two, clear Biocryl or Essix "slip-cover", 1 mm full-arch retainers bonded together with lab acrylic in the advanced position (as determined by a wax bite). The upper and lower slip covers are bonded together from the posterior molar to mesial of the upper cuspid tip, leaving the anterior section open for an airway.

**Reverse curve NiTi wires**
An .017 x .025 or .019 x .025 in size. Manufactured by Orthodontic Specialties with 20 degrees of torque built into the archwire from lateral to lateral. Reverse curve in design, manufactured of nickel titanium. These archwires are particularly effective in severe Class II, div. 2 cases. They are placed in the upper arch following the initial phase of archwire sequencing. If only intrusion is
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desired, the same dimension of archwires are used with 20 degrees of torque.

Rotational control
The ability of an orthodontic delivery system to favorably influence rotated teeth into the proper position. It is typically affected by: 1) depth of bracket slot - a critical range of depth exists 2] usable bracket width - the amount of the bracket that contacts the wire for rotational forces 3] horizontal wire dimension - a critical wire dimension exists.

Rotations are not removed by binding the wire against the back of the bracket. The play between the wire and the slot should be within .002" to .003" for ideal rotational control. Realizing that this bracket depth dimension is critical to rotational control, the depth of the Damon passive self-ligating bracket is reduced from .028 to .027.

Final rotation control should be achieved following the second phase or high-tech edgewise phase of archwire sequencing. The System is designed to use no less than .025" buccolingual edgewise archwires to achieve rotational control. By achieving final rotational control early in treatment (and not losing rotation control during treatment), the teeth can be maintained in its final rotational position for a long period of time, which usually enhances stability.

Sectional archwire
A segment of wire (typically .014 NiTi) inserted in a rotated segment of the arch in order to align teeth prior to placing a larger-dimensioned archwire. Sectional archwires are commonly used to prevent light archwires from being displaced from heavy posterior occlusal forces.

Space closure
Following anterior space consolidation in the high-tech edgewise phase of archwire sequencing, the six anterior teeth are ligated together under the archwire with .008 stainless steel ligature wire. A preposted .019 x .025 stainless steel archwire is inserted with the hooks placed between the laterals and cuspids. Medium NiTi (9 or 12 mm) springs are placed over the end of the slightly protruding archwire clipped distal of the first molars. The other end of the spring is attached to the hook on the archwire with ligature wire. The springs are usually activated approximately 2/3 of their original length. (See En masse retraction for other options used.)

Space consolidation
The process of gathering anterior space between teeth prior to en-masse retraction. Chain elastics are used from lateral to lateral or cuspid to cuspid, depending on the amount of space needed to close. If major space is present, care is given not to round-trip the cuspids. (In this situation, space would be closed lateral to lateral.) Only close anterior space on .014 x .025 or .016 x .025 NiTi archwires in the second phase of archwire sequencing. Closing space on round archwires will cause rotations. If major anterior space
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is involved, the chain elastics are placed prior to insertion of the archwire, thus minimizing friction. (On occasion elastic thread is utilized to control the force of the space closure.) It is preferred to consolidate space distal to the cuspids prior to en-masse retraction of the anterior segment. Space closure is easier if the force vectors are parallel to the major mechanics posterior archwire. All rotations should have been corrected prior to posterior space closure.

Space creation
The process of altering the course of treatment by changing an extremely crowded situation into a nonextraction case. Ideally this is performed in the late mixed dentition stage prior to the eruption of the cuspids. A four tooth sectional .014 wire is placed in the anterior segment to align and control severe rotations. Following the initial phase, an .014 x .025 or .016 x .025 NiTi wire is placed with a compressed NiTi coil spring extending from the lateral incisor to the first molar. Great care is given to only activate the spring approximately 1.5 times the width of the bracket. Too much activation will overpower the lip bumper effect of the orbicularis oris and mentalis muscles. Crimpable stops are placed on either side of a central bracket to prevent the archwire from sliding. The patient is reappointed at an appointment interval, usually 10 weeks, that will not allow the archwire to slide out of the first molar tube. NOTE: This procedure can be performed in conjunction with Herbst therapy by welding a wire tube to the maxillary stainless steel crown and aligning the anteriors as described above. It is also advisable to weld a long molar tube in an attempt to prevent the archwire and spring from becoming dislodged from the molar tube between appointments.

Space management phase
The intermediate period of treatment. This phase generally starts with the consolidation of anterior space with .014 x .025 or .016 x .025 NiTi and elastic chains to control spacing and ends with the .019 x .025 posted wires to close posterior space en masse.

Tiebacks
The method whereby closed spaces in the arches are kept from re-opening during the later phases of treatment. Once all spaces are closed, modules, elastic chains or ligature wires are employed to keep all spaces closed. This typically occurs in the major mechanics and final stages of treatment with the .019 x .025 archwire in place. Tiebacks are strongly recommended in this low-force/low-friction system since is it very easy for space to open.

Tieback module
The auxiliary added to the Damon System to keep spaces closed. They come in a variety of sizes and strengths (recommended: Heavy-Unitek). These are placed on an .019 x .025 archwire and extend intra-arch from the posted hooks on the wire, passing incisal to the first bicuspid in the same arch, ending on the hooks of the first molars.

Tongue influence
It has been noted that the tongue can play a dramatic role influencing the course of orthodontic treatment. In severely crowded cases it appears that the activity of the tongue
previously suppressed due to the extreme crowding and lack of space "wakes up" during treatment once the crowding has been alleviated and lifts to assume a more normal position. The base of the tongue, being in a higher position, can splay out and begin to occupy interocclusal space between the maxillary and mandibular first and second molars, creating a lateral posterior open bite. Corrective action includes recognizing this phenomenon and counteracting the presence of the tongue with "V"-elastics or box elastics.

"V"-elastics
The elastic pattern employed to counteract lateral posterior open bites. Moose (Ormco) elastics are positioned from the posts on an .019 x .025 maxillary archwire, extending under the hook on the gingival of the mandibular first bicuspid bracket and terminating on the first molar hook in the maxillary arch.

Working phase wire
The .016 x .025 NiTi (.014 x .025 NiTi -see Archwire sequencing) archwire employed after the initial leveling and aligning phase with .014/.016 NiTi wire and preceding the major mechanics and final phase .019 x .025 posted archwire. Termed the "heart and soul" of the system because it completes leveling and rotational corrections, consolidates spaces, furthers arch-form development and starts torque control. A panoramic radiograph should be taken one visit following introduction of this archwire to evaluate root positions and final bracket position. Corrections should be made prior to managing spaces and finishing the case. Note the faciolingual dimension (.025) of the workhorse wire is the same as that of the final wire (.025) to give a dimensional match. Patients experience very little discomfort if the proper sequencing is employed as the workhorse wire prepares the case for the final wire.