Case Studies
Volume One

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Table of Contents

Bi-maxillary Protrusion Treated Nonextraction ........................................................... pg 01
Class I Bi-maxillary Protrusion

Clear Fixed Appliance vs. Aligner Treatment for Arch Development ................. pg 09
Class I End-to-End Molar

Clear Fixed Appliance vs. Aligner Treatment for Arch Development ............ pg 17
Class I Narrow Arch

Nonsurgical Correction of CL II Retrognathic Mandible,
TMJ and Gingival Asymmetry ........................................................................ pg 29
Class II Deep Bite

Bilateral Cleft Lip and Palate ........................................................................ pg 41
Class II Cleft Lip and Palate

Correction of Anterior Crossbite Due to Tooth Loss with Early Elastics .......... pg 51
Class I and Class III Anterior Crossbite

Damon Archwire Sequence ........................................................................ pg 63
Bi-maxillary Protrusion
Treated Nonextraction

Clinician: Dr. Stuart Frost, Phoenix, AZ
Patient: M.C.

Pretreatment Diagnosis

Class I, bi-maxillary protrusive patient, 25 years old, presented having had prior orthodontic treatment. A current dental student, her chief concern was her flared front teeth. She was adamant about not having tooth extractions.

Facial/Soft Tissue/Macroesthetics

Normal cephalic convex profile with an acute nasolabial angle. Her upper lip protruded beyond her lower lip with a pleasing vermilion display. Slight upper lip fullness and slight lip strain when lips were at rest.

Smile/Miniesthetics

90% incisor display upon smiling, narrow maxillary transverse arch with upper incisor protrusion, but an adequate smile arc.

Teeth/Microesthetics

Asymmetrical gingival architecture and triangular-shaped teeth in both arches.

Appliance Used

Damon® 3MX
**Treatment Objectives and Plan**

Treat nonextraction, eliminating the crowding by widening the arches, using Damon 3MX brackets. Employ variable torque to detorque the anterior teeth, then reshape the anteriors (upper and lower arches) so they are more pleasing in shape. Employ Dr. Tom Pitts’s bracket positioning to maintain the smile arc.

**Bonding**

**U/L:** Direct bonded 7-7, placing .014 round Damon Optimal Force Copper Ni-Ti® archwires.

**U:** Placed a stop.

**2.5 Months**

**1st Visit**

**U/L:** Transitioned to .018 round CuNi-Ti archwires. See note in Case Discussion.

**U:** Maintained the stop.

**4 Months**

**2nd Visit**

**U:** Transitioned to a .014 x .025 CuNi-Ti archwire, maintaining the stop.

**L:** Maintained the .018 CuNi-Ti archwire. Performed slight IPR to begin reshaping triangular teeth.

**5 Months**

**3rd Visit**

**U:** Transitioned to a .018 x .025 CuNi-Ti archwire, maintaining the stop.

**L:** Maintained the .018 CuNi-Ti archwire. Performed additional IPR on the lower arch.

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**D3MX Variable Torques Employed**

- **U2-2:** Standard torque, reversed (+12° to -12° for central; +8° to -8° for lateral)
- **U3s:** High torque (+7°)
- **L2-2:** Low torque (-6°)
- **LL3:** Standard torque (0°)
- **LR3:** High torque (+7°)

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1All Copper Ni-Ti wire used is Damon Optimal Force Copper Ni-Ti.
6.5 Months
4th Visit

**U:** Transitioned to a .019 x .025 TMA archwire, placing 20° of lingual crown torque U2-2 and maintaining the stop.

**L:** Transitioned to a .014 x .025 CuNi-Ti archwire.

7.75 Months
5th Visit

**U/L:** Took interim panograph and repositioned U1s, UR4 and 5 and LR3. Slenderized U/L 2-2 and placed power chain 3-3.

**U:** Replaced the .019 x .025 TMA archwire, maintaining the 20° of lingual crown torque U2-2 and the stop.

**L:** Maintained the .014 x .025 CuNi-Ti archwire.

9.25 Months
6th Visit

**U:** Repositioned UR1. Replaced the .019 x .025 TMA archwire, maintaining the 20° of lingual crown torque U2-2 and the stop.

**L:** Transitioned to a .017 x .025 Ni-Ti archwire pretorqued with 20° of lingual crown torque. Placed power chain L6-6.

10.25 Months
7th Visit

**U:** Transitioned to a .019 x .025 stainless steel archwire, placing 15° of lingual crown torque U2-2, widening the Damon arch form 2-4 mm in the buccal segments, bilaterally. Ligature tied U3-3 and maintained the stop. While the patient’s arch width was developing adequately without widening the archwire, the added arch width will assist in uprighting the anteriors. Dr. Dwight Damon recommends that the .019 x .025 stainless steel finishing wire remain in place for six months to extract its full benefit, which was the plan for this case.

**L:** Transitioned to a .019 x .025 TMA archwire. Ligature-tied L3-3.
11 Months
8th Visit

U: Slenderized and shaped incisors U3-3. Replaced the .019 x .025 stainless steel archwire, adding a 2nd order bend (mesial root tip) in UL1, and maintaining the 15° lingual crown torque U2-2 and ligature ties U3-3.

L: Maintained the .019 x .025 TMA archwire and ligature ties L3-3.

12 Months
9th Visit

U: Performed IPR U2-2. Replaced the .019 x .025 stainless steel archwire, maintaining the 2nd order bend (mesial root tip) in the UL1, the 15° lingual crown torque U2-2 and ligature ties U3-3. Placed power chain U6-6 and maintained stop mesial to UL4. At this point, I’m focusing on the patient’s microesthetics. The UL1 needs more extrusion and the anteriors are still flared. Even with having flipped the U2-2 brackets upside down for added lingual crown torque, widened the stainless steel archwire for anterior uprighting and added lingual crown wire torque, the anteriors will require the additional weeks of treatment to be uprighted. Because it is difficult to add torque to posted wires and since there were no major mechanics that required posts in this case, unposted wires had worked best to this point.

L: Maintained the .019 x .025 TMA archwire, ligature ties L3-3 and added power chain L6-6.

13 Months
10th Visit

U: Reshaped U2-2 slightly. Checked the torques and replaced the .019 x .025 stainless steel archwire, maintaining the 2nd order bend (mesial root tip) in UL1, the 15° lingual crown torque U2-2, ligature ties U3-3 and power chain U6-6.

L: Maintained the .019 x .025 TMA archwire, ligature ties L3-3 and power chain L6-6.
14 Months

11th Visit

U: Replaced the .019 x .025 stainless steel archwire, maintaining the 2nd order bend (mesial root tip) in UL1, the 15° lingual crown torque U2-2, ligature ties U3-3 and power chain U6-6.

L: Maintained the .019 x .025 TMA archwire, ligature ties L3-3 and power chain L6-6.

Taking photographs without wires in place allows me to see tooth inclinations better. Took impressions to make study models for finishing assessments. The upper incisors need further uprighting, but the spaces are closing and the buccal segments, canine to molar, are in good alignment.

15.25 Months

12th Visit

U: Performed IPR U2-2. Replaced the .019 x .025 stainless steel archwire, maintaining the 2nd order bend (mesial root tip) in UL1, the 15° lingual crown torque U2-2 and the ligature ties U3-3. Added a step-down bend UL5 and ligated power chain to U7-7.

L: Maintained the .019 x .025 TMA archwire, ligature ties L3-3 and ligated power chain L7-7.

U/L: Started Moose 5/16”, 6 oz. box elastics (bilaterally, U6 to crimped posts mesial to U3 and L3 to L6, full-time).

15.75 Months

13th Visit

U: Replaced the .019 x .025 stainless steel archwire, maintaining the 2nd order bend (mesial root tip) in UL1, the 15° lingual crown torque U2-2, ligature ties U3-3, the UL5 step-down bend and power chain U7-7.

L: Maintained the .019 x .025 TMA archwire, ligature ties L3-3 and power chain L7-7.

U/L: Maintained box elastics. Took impressions for permanent retainers.
16 Months
Final Visit, 68 Weeks
13 Treatment Appointments

U/L: Removed all appliances. Shaped and polished all the teeth. Took impressions for 1 mm Essix-formed clear overlays. Patients are to wear overlays full-time for the first 6 weeks and then nighttime only thereafter. Bonded upper permanent retainer U2-2, just on the 2s, starting at the UR2, shaping the wire tooth by tooth using .016 x .022 Bond-a-Braid™ lingual retainer wire (Reliance Orthodontic Products, Itasca, IL). Bonded lower retainer, every tooth, L3-3 using an .026 stainless steel wire, forming looping bends on each end. The lower fixed retainer is to be bonded for life. If the upper fixed retainer comes loose after 18 months, we rebond it if the patient originally had 3-4 mm of spacing pretreatment.

At the end of treatment, I finished shaping the U/L anteriors with a round diamond wheel, then used heavy, medium and light sandpaper discs (Shofu Dental Corporation, San Marcos, CA) on the incisal embrasures for polishing and shaping. Finally, I polished the facial surfaces with a black polishing point (Reliance Orthodontic Products, Itasca, IL). Given the time and effort it takes to complete a case, it seems only sensible to shape anteriors throughout treatment and at the end of it to heighten the quality of a good result.

16 Months - Treatment Complete
We achieved all treatment objectives and satisfied the patient’s chief concern, while complying with her request for nonextraction therapy.

Determining when to transition from the round wire phase to the first rectangular wire is a decision I base on two considerations. If there is still moderate crowding in either of the arches and/or the patient is still experiencing moderate soreness, I transition from the .014 round to a .018 round CuNi-Ti archwire before transitioning into the first rectangular wire, a .014 x .025 CuNi-Ti archwire. One of the keys to the Damon optimal-force, low-friction appliance system is allowing archwires adequate time to unravel teeth in the round-wire phase. In this case, I maintained the second round archwire (a .018 CuNi-Ti) in the lower arch for 17 weeks, performing sequential IPR while transitioning through the first two rectangular archwires in the upper arch, which was much less crowded.

Repositioning brackets is also of great importance to high-quality finishes. No matter how well I think I’ve placed brackets at bonding, I usually find that I need to reposition a few bonds. I take an interim panograph to check for root positions six weeks after both arches have had a rectangular wire in place for several weeks, repositioning brackets accordingly, but I also check bonds at every appointment thereafter and reposition any bracket that mandates it. The little additional time that this takes is always worth it.

**What I Would Do Differently Today**

Needing even lower low-torque bracket options for such cases is the reason that Dr. Dwight Damon worked withOrmco to increase the low-torque choices in the Damon Q™ (DQ) prescription. Even though I reversed the regular torque U2-2 brackets for greater lingual crown torque, I still had to add wire torque in the upper arch from the 4th visit on. On each of these visits, I would use Tweed pliers to check the degree of torque in the newly disengaged wire by holding it in the pliers parallel to the floor, then determine whether to maintain the current torque or add more (never more than 20°). I maintain the finishing torque as holding torque until the end of treatment. While it might seem that adding 20° of torque to upside-down U2 brackets already offering 12° of lingual crown torque might seem excessive, there is approximately +/-11° of wire-to-bracket play between a .019 x .025 archwire and a .022 x .028 lumen, which diminishes the applied torque by the amount of play. With the high-torque options now available with DQ, I might not have had to add wire torque, a time-consuming and inconsistent protocol.

I think this case could have had an even more pleasing esthetic result if I had extruded the upper centrals more (by repositioning the brackets more gingivally or by putting in step-down bends) for a better smile arc. I also wish I had reshaped the lower lateral incisors slightly more; otherwise, I am very happy with the result and the patient was quite delighted as well.

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**Case Discussion**

| Initial | Final |
- Choose 15 oz. to 20 oz. crimped posts mesial to U3 and L3.

**Box elastics, U6 to crimped posts mesial to U3 and L3 to L6, Moose, 5/16" 6 oz.**

*Pretorqued with 20° of lingual crown torque 2-2

**Wire Sequence Chart**

Clinician: Dr. Stuart Frost, Phoenix, AZ

Patient: M.C.
Clear Fixed Appliance vs. Aligner Treatment for Arch Development

Clinician: Dr. Stuart Frost, Phoenix, AZ
Patient: A.M.

Pretreatment Diagnosis

Class I (end-to-end molar on right), female patient, 38 years old, presented inquiring about clear aligner treatment. She had had orthodontic treatment by another clinician years before. I had treated both of her children with the Damon® System and she had been pleased with the results. Given that her chief concerns were the crowding in her lower arch and the widening of her smile, I was able to convince her that passive self-ligation would offer her the results she wanted and could satisfy her need for an esthetic option with Damon Clear™ which was then in prototype form. She had no jaw popping or clicking.

Facial/Soft Tissue/Macroesthetics
Mildly convex profile with a mildly convex nasolabial angle. Slight lip strain when lips were at rest with lower midline shifted to the right.

Smile/Miniesthetics
Excessive gingival display in the maxilla, narrow arches with 3 to 4 mm of crowding in the lower arch and 1 to 2 mm of crowding in the upper arch. Consonant smile arc.

Teeth/Microesthetics
Esthetically-shaped teeth in both arches and excellent hygiene. Inconsistent gingival architecture in the lower anteriors and upper R3.

Appliances Used

Damon Clear Prototype
Damon Q™
Treatment Objectives and Plan

Treat nonextraction, eliminating the crowding by widening the arches, using the Damon Clear prototype brackets U3-3 and Damon Q elsewhere. Employ variable torque to foster the proper inclinations in the anterior teeth and Dr. Tom Pitts’s bracket positioning to maintain the smile arc.

Damon Clear/DQ Variable Torques Employed

- **U1s**: Standard torque (+15°)
- **U2s**: Low torque (-5°)
- **U3s**: Standard torque (+7°)
- **L2s**: Low torque (-11°)
- **LL3**: Super torque (+13°)
- **LR3**: Standard torque (+7°)

Treatment Sequence

**Bonding**

**U/L**: Direct-bonded 7-7, engaging .014 round Damon Optimal Force Copper Ni-Ti® archwires.

**U**: Placed a stop between U1s.

**1 Month**

1st Visit

**U**: Transitioned to a .014 x .025 CuNi-Ti archwire. Ligature-tied U2-2. Added a stop distal to UR1.

**L**: Transitioned to a .018 round CuNi-Ti archwire.

**U/L**: Started Quail, 3/16”, 2 oz., Shorty CL II elastics (bilaterally L6 to U4, full-time), maintaining them throughout treatment.

1 All Copper Ni-Ti wire used is Damon Optimal Force Copper Ni-Ti.
1.5 Months
2nd Visit

U: Transitioned to a .018 x .025 CuNi-Ti archwire. Maintained ligature ties U2-2 and moved the stops between U1s and between UL1-2. Positioning of the stops is at the assistant’s discretion.

L: Transitioned to a .014 x .025 CuNi-Ti archwire. Ligature-tied L3-3, maintaining it throughout treatment.

U/L: Maintained Shorty CL II elastics.

3 Months
3rd Visit

U: Repositioned the UR3 and dropped the wire size to a .014 x .025 CuNi-Ti archwire. Maintained ligature ties U2-2 and moved stops mesial and distal to UR1.

L: Maintained the .014 x .025 CuNi-Ti archwire and ligature ties L3-3.

U/L: Maintained Shorty CL II elastics.
4.5 Months
4th Visit

U: Transitioned to a .018 x .025 CuNi-Ti archwire and maintained ligature ties U2-2. Removed all stops.

L: Maintained the .014 x .025 CuNi-Ti archwire and ligature ties L3-3.

U/L: Maintained Shorty CL II elastics.

5.5 Months
5th Visit

U: Maintained the .018 x .025 CuNi-Ti archwire. Ligature-tied U3-3.

L: Maintained the .014 x .025 CuNi-Ti archwire and ligature ties L3-3.

U/L: Took interim panograph and repositioned UR4, LR1 and LR3. The repositionings were minor so did not have to reduce the wire dimensions. Maintained Shorty CL II elastics.
6.5 Months
6th Visit

U: Transitioned to a .019 x .025 TMA archwire, adding 15° of buccal crown torque to the UL3, maintaining ligature ties U3-3.

L: Transitioned to a .017 x .025 TMA archwire and put a step-up bend in the LR4. Maintained ligature ties L3-3.

U/L: Maintained Shorty CL II elastics, but transitioned to nighttime only.

7.25 Months
7th Visit

U: Maintained the .019 x .025 TMA archwire, putting a step-down bend UL1. Maintained ligature ties U3-3.

L: Maintained the .017 x .025 TMA archwire and ligature ties L3-3.

U/L: Maintained Shorty CL II elastics.
7.75 Months
Final Visit, 35 weeks
7 Treatment Appointments, 2 Emergency Visits

U/L: Removed all appliances. Shaped and polished the teeth. Took impressions for 1 mm Essix-formed clear overlay U/L retainers. Bonded permanent retainer U2-2, just on the 2s, starting at the UR2, shaping the wire tooth by tooth using .016 x .022 Bond-a-Braid™ lingual retainer wire (Reliance Orthodontic Products, Itasca, IL). Bonded lower retainer, every tooth, L3-3 using an .026 stainless steel wire, forming looping bends on each end. The lower fixed retainer is to be bonded for life. If the upper fixed retainer comes loose after 18 months, we rebond it if the patient originally had 3-4 mm or more of spacing pretreatment. Two weeks later, took final records and delivered clear retainers.

7.75 Months - Treatment Complete
Dr. Stuart Frost | Class I End-to-End Molar

Case Discussion

We achieved all treatment objectives and satisfied the patient’s chief concerns. Interestingly, widening the patient’s transverse arch width, especially the U2-2, had the added benefit of diminishing the excess upper gingival display. In this case and others, I began experimenting with using #4 test fishing line rather than ligature wire to consolidate teeth. It has proven to work effectively and since it is clear, it is more appealing to patients.

While the patient had originally inquired about clear aligner treatment, the fee would have been substantially more and would not have allowed us to reach her objectives. While clear aligner treatment can satisfy the objectives of certain adult cases, esthetic fixed appliance treatment allows us to achieve outstanding results.

What I Would Do Differently Today

The patient had a lateral tongue thrust at the UR3, which plagued me throughout treatment. Were I to treat the case today, I would place lingual tongue reminders in the LR3 that would likely have resulted in a more satisfactory Class I right cuspid relationship.

Initial

Final

Arch Development
Wire Sequence Chart

Clinician: Dr. Stuart Frost, Phoenix, AZ

Patient: A.M.

Herbst/Elastics

0.017 x 0.025 TMA

0.014 x 0.025 CuNi-Ti

0.019 x 0.025 TMA, adding 15° of buccal crown torque UL3

0.017 x 0.025 TMA

0.014 x 0.025 CuNi-Ti

0.018 x 0.025 CuNi-Ti

Quail, 3/16, 0.2 oz. Shorty CL II Elastics, L6 to U4

0.018 CuNi-Ti
Class I female patient, 36 years old, presented with chief concerns being the toed-in aspect of her cuspids and the narrowness of her smile. She and her daughter both had previous orthodontic treatment and were not satisfied with the results. I had retreated her daughter to a beautiful finish. The patient is a high-profile real estate professional and was willing to undergo orthodontic treatment again if her issues could be addressed with an esthetic fixed appliance-Damon® Clear™, which was then in prototype form.

Facial/Soft Tissue/Macroesthetics

Smile/Miniesthetics
Excessive, slightly asymmetrical gingival display in the maxilla (especially UR3) and inconsistent gingival architecture in lower anteriors. Slightly narrow upper arch with 1 to 2 mm of crowding and normal lower arch with 1 to 2 mm of crowding. Consonant smile arc. Moderate overbite (50%) and normal overjet (1 to 2 mm). 90% incisor display on smile with only a slight need for expansion in the buccal corridors. Midline off slightly to the left.

Teeth/Microesthetics
Esthetically-shaped teeth in both arches. Excellent oral hygiene. Slightly short upper left lateral incisor. Cuspids and upper buccal segment linguually inclined.
Dr. Stuart Frost | Class I Narrow Arch

**Treatment Objectives and Plan**

Treat nonextraction, eliminating the crowding by widening the arches, using the Damon Clear prototypes U3-3 (participating in a clinical evaluation) and Damon Q elsewhere. Employ variable torque to foster the proper inclinations in the anterior teeth and follow Dr. Tom Pitts’s bracket positioning techniques to align buccal segment cusp tips and marginal ridges and protect the smile arc, enhancing it if possible. Correct the midline.

**Damon Clear/DQ Variable Torques Employed**

- **U1s**: Standard torque (+15°)
- **U2s**: Standard torque (+6°)
- **U3s**: Standard torque (+7°)
- **L1-2s**: Standard torque (-3°)
- **L3s**: Standard torque (+7°)

**Treatment Sequence**

**Bonding**

**U/L**: Direct-bonded U6-6, L7-7, engaging .014 round Damon Optimal Force Copper Ni-Ti archwires, ending at the L6s.

**U**: Placed stops mesial and distal to UR1.

**L**: Placed stops between LL1-2.

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1 Month

1st Visit

**U/L**: Transitioned to .018 CuNi-Ti archwires, engaging the L7s. I use the .018 dimension archwire to transition to the first rectangular archwire when there are rotations and, as in this case, the patient reports soreness.

**U**: Rebonded UR6. Maintained stops mesial and distal to UR1.

**L**: Maintained stops between LL1-2.

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*All Copper Ni-Ti wire used is Damon Optimal Force Copper Ni-Ti.*
2 Months
2nd Visit

U/L: Transitioned to .014 x .025 CuNi-Ti archwires. Note: The patient is shifting her jaws during photographing.

U: Ligature-tied U3-3. Moved stops distal to U3s. At this point there is no need for two stops, but the assistant added the additional stop at her discretion. Where the stops are placed is the preference of the particular assistant.

L: Moved stops distal to L3s.

3.5 Months
3rd Visit

U/L: Took interim panograph.

U: Repositioned brackets UL1-2, LR2. Because the repositions were not significant, transitioned to .016 x .025 CuNi-Ti archwire. Maintained stops distal to U3s and ligature-ties U3-3.

L: Maintained .014 x .025 CuNi-Ti archwire. Maintained stops distal to L3s.
4.5 Months

4th Visit

_U_: Transitioned to .018 x .025 CuNi-Ti archwire. Placed stops mesial and distal to UR1. Maintained ligature ties U3-3.

_L_: Maintained .014 x .025 CuNi-Ti archwire and stops distal to L3s. Repositioned LR3.

5.8 Months

5th Visit

_U_: Replaced UR3 bracket with super torque Damon Q bracket (+11°). I replaced the Damon Clear bracket with the DQ because I required labial torque that would have taxed the prototype bracket. Damon Clear now has +11° (super torque) for its U3 bracket prescription and since that time, Damon Clear has been redesigned and strengthened considerably. Transitioned to a .019 x .025 TMA archwire, placed 7° to 10° labial crown torque in the U3s and widened the archwire (standard Damon arch form) 2 mm in the posterior bilaterally. Changed ligature ties to UR2 to UL3. Removed stops.

_L_: Transitioned to a .018 x .025 CuNi-Ti archwire. Ligature-tied L3-3. Removed stops.

6.8 Months

6th Visit

_U_: Replaced the .019 x .025 TMA archwire, maintaining 7° to 10° labial crown wire torque in U3s and the posterior expansion. Maintained ligature ties UR2 to UL3.

_L_: Maintained the .018 x .025 CuNi-Ti archwire and ligature ties L3-3.
7.75 Months
7th Visit

U: Replaced the .019 x .025 TMA archwire, maintaining 7° to 10° labial crown wire torque in U3s and the posterior expansion. Maintained ligature ties UR2 to UL3.

L: Transitioned to a .017 x .025 TMA archwire, adding 5° of lingual crown torque to L2s. Maintained ligature ties L3-3.

8.7 Months
8th Visit

U: Replaced the .019 x .025 TMA archwire, maintaining 7° to 10° labial crown wire torque in U3s and the posterior expansion. Ligature-tied U3-3.

L: Rebonded LR6. Replaced .017 x .025 TMA archwire, replacing 5° lingual crown wire torque in L2s. Maintained ligature ties L3-3.
9.6 Months
9th Visit

U: Replaced UL3 with a super torque DQ bracket (+11°). Damon Clear now has +11° (super torque) for its U3 bracket prescription and has also been strengthened to accommodate moderate wire torques. Replaced the .019 x .025 TMA archwire, maintaining 7° to 10° labial crown torque in U3s and posterior expansion.

L: Replaced .017 x .025 TMA archwire in the lower arch and put step-down bends L2s. Engaged k-ties (bilaterally L6 over 4 to post on L3). Ligature-tied LR3-LL2.

10.6 Months
10th Visit

U: Bonded U7s. Replaced the .019 x .025 TMA archwire, maintaining 7° to 10° labial crown torque in U3s and posterior expansion. Slenderized U1s. Changed ligature ties to U1-1. Engaged k-ties (U6 over 5 under 4 to post mesial to U3) and added 5° lingual crown torque to UR2.

L: Replaced .017 x .025 TMA archwire in the lower arch, maintaining step-down bends L2s and k-ties (bilaterally L6 over 4 to post on L3). Ligature-tied L3-3.
11.3 Months
11th Visit

**U:** Replaced the .019 x .025 TMA archwire in the upper arch, maintaining 7° to 10° labial crown torque in U3s and posterior expansion and putting step-down bends in UR1 and UL2. Repositioned brackets on UR4 and 5, maintained ligature ties U1-1, k-ties (U6 over 5 under 4 to post mesial to U3) and added power chain U3-3.

**L:** Replaced .017 x .025 TMA archwire in the lower arch, maintaining step-down bends L2s, k-ties (bilaterally L6 over 4 to post on L3) and ligature ties L3-3.

11.75 Months
12th Visit

**U:** Replaced the .019 x .025 TMA archwire, maintaining 7° to 10° labial crown torque in U3s and posterior expansion and putting step-down bends in U1s and UR 4 and 5. Performed IPR on U2s. Changed ligature ties to U3-3 and power chain to U6-6.

**L:** Replaced the .017 x .025 TMA archwire, maintaining step-down bends L2s, k-ties (bilaterally L6 over 4 to post on L3) and ligature ties L3-3.
12 Months

13th Visit

**U:** Maintained the .019 x .025 TMA archwire, maintaining 7º to 10º labial crown torque in U3s and posterior expansion and put a step-down bend UL2. Maintained ligature ties U3-3 and power chain U6-6. Took impression for permanent retainer.

**L:** Replaced .017 x .025 TMA archwire, maintaining the step-down bends L2s, k-ties (bilaterally L6 over 4 to post on L3) and ligature ties L3-3.
12.5 Months

Final Visit, 53 weeks
16 Treatment Appointments, 2 Emergency Visits and 1 Wire Removal Appointment for Dental Cleaning

U/L: Removed all appliances. Shaped and polished the teeth. Bonded an upper permanent retainer U2-2 (.016 x .022 Bond-a-Braid™ lingual retainer wire from Reliance Orthodontic Products, Itasca, IL) and a lower permanent retainer, every tooth L3-3, using an .026 stainless steel wire, forming looping bends on each end. The lower fixed retainer is to be bonded for life. If the upper fixed retainer comes loose after 18 months, we rebond it if the patient originally had 3-4 mm or more of spacing pretreatment. Delivered the lower clear removable retainer for the patient to wear full-time. Patient returned a week later for the delivery of the upper clear removable retainer.
Patient had final records taken approximately six months after the end of treatment. Subsequent retention checks found the upper and lower retainers still bonded. Five months after the end of treatment, the patient switched to clear retainer wear nighttime only.
Case Discussion

In each case, my overall goal for treatment is to create a high-quality result that doesn’t draw attention to any particular aspect of a patient’s smile. In this patient’s case, the lingually inclined cuspids had been particularly distracting. We met all the goals for treatment as well as the patient’s goals for this case, specifically enhancing the smile arc and uprighting the canines and buccal segments, which had the effect of widening the smile slightly. We also corrected the midline. Because this case was part of the clinical evaluation for Damon Clear, I maintained 4-week appointment intervals to monitor the case closely. Otherwise, I followed my typical wire sequence and had no issues with breakage of Damon Clear. I did have to replace Damon Clear U3 brackets with Damon Q brackets because this early prototype prescription did not offer sufficient built-in torque for this case and because I still needed to torque the TMA wire substantially to foster the inclination required. The standard torque in the prototype prescription was +7° and not sufficient to foster the labial crown torque required. Had the new prescription for super torque for the U3s (+11°), been available, I believe that torque would have been sufficient. I prefer to finish such cases in TMA wires, which allows me to bend wire torques to detail cases to beautiful results.
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<thead>
<tr>
<th>Wire Sequence Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinician: Dr. Stuart Frost, Phoenix, AZ</td>
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<tr>
<td>Patient: C.R.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Maxillary Hardware</th>
<th>Mandibular Hardware</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.014 x 0.025 CuNi-Ti</td>
<td>0.017 x 0.025 TMA, adding 7˚-10° labial crown torque in the 3s and widening the archwire.</td>
</tr>
<tr>
<td>5</td>
<td>0.016 x 0.025 CuNi-Ti</td>
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<tr>
<td>10</td>
<td>0.018 x 0.025 CuNi-Ti</td>
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<tr>
<td>15</td>
<td>0.019 x 0.025 TMA, adding 7˚-10° labial crown torque in the 3s and widening the archwire.</td>
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<tr>
<td>25</td>
<td>0.017 x 0.025 TMA, adding 5° of lingual crown torque in the 2s</td>
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<td>30</td>
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<tr>
<td>35</td>
<td>0.019 x 0.025 TMA, adding 7˚-10° labial crown torque in the 3s and widening the archwire.</td>
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<tr>
<td>40</td>
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<td>50</td>
<td>0.018 x 0.025 CuNi-Ti</td>
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<tr>
<td>55</td>
<td>0.017 x 0.025 TMA, adding 7˚-10° labial crown torque in the 3s and widening the archwire.</td>
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</tbody>
</table>

Note: The sequence chart includes wire changes and hardware adjustments for treatment progression.
Nonsurgical Correction of CL II Retrognathic Mandible, TMJ and Gingival Asymmetry

Clinician: Dr. Stuart Frost, Phoenix, AZ
Patient: S.M.

Pretreatment Diagnosis

Class II, deep bite patient presented with chief complaint of jaw pain and too much maxillary gingival display on her left side. She had clicking and popping in both jaws while opening and closing her mouth and reported a pain level of 7 on a VAS scale. She had been to several orthodontists for evaluation and each said that she would need surgery to correct the gingival asymmetry.

Facial/Soft Tissue/Macroesthetics

Normal cephalic profile with a retrognathic mandible and a slightly obtuse nasolabial angle with her upper lip projecting beyond her lower lip but with a good vermillion display. Upon smiling, she had a 4 mm asymmetrical gingival display above the upper left central posteriorly.

Smile/Miniesthetics

Over 100% incisal display upon smiling, which is asymmetrical, with an asymmetrical smile arc. Narrow upper transverse width.

Teeth/Microesthetics

Asymmetrical gingival architecture. Upper centrals appear overerupted with a 100% deep bite.

Appliances Used

Damon® 3MX
VectorTAS™ Temporary Anchorage
Herbst®

1Herbst is a registered trademark of Dentaurum, Inc.
**Treatment Objectives and Plan**

Relieve her jaw pain, correct the Class II malocclusion and address possible anterior disc displacement through use of Herbst molar-to-molar Class II corrector, and follow the Dr. Terry Dischinger protocol. This protocol stipulates placing brackets U5-5 and L4-4 at bonding. The Herbst appliance will be in place 10-12 months. Widen the narrow transverse arch width using the Damon 3MX (D3MX) appliance.

Correct the asymmetrical gingival display using two VectorTAS miniscrews on the upper left side to intrude the upper left quadrant, placing the TADs after progressing to a .019 x .025 stainless steel archwire in the upper arch. The TADs will be in place for 6 months. Total treatment time should be approximately 24 months. Retention will employ a muscle-training splint.

**Damon 3MX Variable Torques Employed**

- **U1s:** High torque (+17°)
- **U2s:** Standard torque (+8°)
- **U3s:** High torque (+7°)
- **L2-2:** Standard torque (-1°)
- **L3s:** High torque (+7°)

**Treatment Sequence**

**Bonding**

**U/L:** .013 round Damon Optimal Force Copper Ni-Ti® archwires. Delivered Herbst and advanced it 5 mm to edge to edge. Engaged wires directly into the Herbst crowns on the upper arch but the assistant inadvertently cut the wire distal to the L4s, which caused mild tipping.

**U:** Placed bite turbos lingually on the 1s using Mini-Molds (Ortho Arch, Schaumburg, IL) and Triad® Gel (Dentsply, York, PA) so that the patient would have a biting surface after the Herbst was advanced. Ligature-tied U6-6 to allow as much movement as possible in the lower arch. Placed stops mesial and distal to UR1.

**2 Weeks**

Appliance check. Patient reported TMJ pain was gone and that she was feeling great.

**2.25 Months**

**Emergency** - Replaced broken lower archwire.

2. All Copper Ni-Ti archwires used in this case were Damon Optimal Force Copper Ni-Ti.
2.5 Months
1st Visit

U: Transitioned to .014 x .025 CuNi-Ti archwire. Maintained ligature ties U6-6 and the stops mesial and distal to UR1.

L: Maintained .013 round CuNi-Ti archwire.

U/L: Engaged wires through the tubes on the Herbst crowns, which would recover the tipping of the L4s.

2.75 Months

Emergency: Removed Herbst because of patient discomfort. Took new impression to fabricate another Herbst.
4 Months
2nd Visit
U/L: Re-cemented new Herbst. Advanced left side 2 mm; right side, 1 mm.
U: Transitioned to a .018 x .025 CuNi-Ti archwire to level U6-4. Maintained stops mesial and distal to U1s. The assistant changed the U6-6 ligature ties to power chain U3-3.
L: Transitioned to .018 round CuNi-Ti archwire. The Herbst rests on the 5s, which tends to intrude these teeth; the round .018 CuNi-Ti archwire is not strong enough to preclude mesial tipping of the L6s. Unfortunately, the assistant again cut the lower archwire distal to the L4s. Engaging the wire throughout the arch would have helped in extruding the L5s. These issues will be managed as treatment progresses.

6.5 Months
3rd Visit
U: Maintained .018 x .025 CuNi-Ti archwire and stops mesial and distal to U1s. Changed from power chain U3-3 to ligature-ties U6-6.
L: Transitioned to a .014 x .025 CuNi-Ti archwire.

7.5 Months
4th Visit
U: Transitioned to a .019 x .025 TMA archwire, placing 15° of buccal crown torque U2-2 and stops mesial and distal to UR1.
L: Maintained .014 x .025 CuNi-Ti archwire. Placed 3 mm shims to advance the Herbst edge-to-edge.

8 Months
Emergency: Addressed a poking wire.
9.5 Months
5th Visit

U/L: Removed the Herbst prematurely because it was bothering the patient. Bonded 6s, 7s and L5s. Dropped back to .014 round CuNi-Ti archwires in both arches, cutting the wires distal to 6s. Placed one stop distal to UR4 and one between the L1s. Started Quail, 3/16”, 2 oz., Shorty CL II elastics (bilaterally L6 to U4, full-time). When using a Herbst, I like to overcorrect to a negative 1 mm overjet, then use elastics to maintain the occlusion. In this case, the occlusion had only reached edge-to-edge by the time we removed the Herbst so I needed to engage elastics to prevent relapse throughout the remainder of treatment.

L: Engaged a bite bumper (Elastomeric Ligature with Guard from 3M/Unitek, Monrovia, CA) on LL1 to protect the UR1.

1 Week Later
Emergency: Patient called after the Herbst removal to report popping in her right joint. She had no pain so I told her not to worry.

11.25 Months
6th Visit

U/L: Transitioned to .014 x .025 CuNi-Ti archwires, running the wires back to the 7s and maintaining the elastics, advancing to Full Class II attachment and increasing size to Parrot, 5/16”, 2 oz., full-time. Ligature-tied U/L3-3.
**12.5 Months**

7th Visit

**U:** Transitioned to a .019 x .025 TMA archwire, placing 15° of labial crown torque U2-2.

**L:** Transitioned to a .017 x .025 TMA archwire, placing 15° of lingual crown torque L2-2. Added Elastomeric Ligature with Guard to LR1 so that both upper 1s were protected. Removed all stops.

**U/L:** Maintained the CL II elastics and ligature ties U/L3-3.

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**13 Months**

**Emergency:** Rebonded LL6.

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**13.5 Months**

8th Visit

**U:** Replaced the .019 x .025 TMA archwire, maintaining the 15° of labial crown torque U2-2.

**L:** Replaced the .017 x .025 TMA archwire, maintaining 15° of lingual crown torque L2-2.

**U/L:** Maintained the CL II elastics and ligature ties U/L3-3. Took interim panograph and repositioned L1s and L3.
16.5 Months
9th Visit

U: Transitioned to a .019 x .025 stainless steel archwire. Did not replace the labial crown wire torque since the TADs would tend to cause upper incisor proclination. To address the cant, placed a 6 mm TAD between the UL2 and 3 and a 8 mm TAD between the UL4 and 5. To each TAD, attached a 150 g, 10 mm spring to the miniscrew head, looping it under the archwire and back to itself. Instructed the patient to use a toothbrush and the clora hexdine provided to clean the TADs.

L: Replaced .017 x .025 TMA archwire, maintaining the 15° of lingual crown torque L2-2. Placed a stop distal to LR3.

U/L: Maintained the CL II elastics and ligature ties U/L3-3.

1 Week Later
Checked TADS. They were secure and functioning properly.

17.5 Months
10th Visit

U: Maintained the .019 x .025 stainless steel archwire and TAD attachments.

L: Transitioned to a .019 x .025 TMA archwire, placing 15° of lingual crown torque L2-2.

U/L: Reduced Class II Parrot elastics to nighttime only and maintained ligature ties U/L 3-3.

17.75 Months
Emergency: Patient felt TADS were pulling asymmetrically, but there was no problem.
Dr. Stuart Frost | Class II Deep Bite

18.5 Months
11th Visit
U/L: Maintained archwires with 15° of lingual crown torque L2-2, TAD attachments, ligature ties U/L 3-3 and CL II elastics, increasing size to Fox, 1/4”, 3.5 oz., full-time

19.5 Months
12th Visit
U: Replaced springs on TADs. Added closing springs to close space between 6s and 7s, bilaterally.
U/L: Maintained archwires with 15° of lingual crown torque L2-2 and CL II elastics.

20.25 Months
13th Visit
U: Added power chain U3-3. Replaced spring on TADs with power chain. Activated closing springs between 6s and 7s, bilaterally.
U/L: Maintained archwires with 15° of lingual crown torque L2-2 and CL II elastics.

21.5 Months
14th Visit
U: Deactivated anterior TAD attachment. Adjusted power chain to posterior TAD. Changed power chain to U7-7.
U/L: Maintained archwires with 15° of lingual crown torque L2-2 and CL II elastics.

22 Months
15th Visit
U: Repositioned UR6. Maintained power chain U7-7. Added closing spring U7-2 to close space that had opened.
U/L: Maintained archwires with 15° of lingual crown torque L2-2 and CL II elastics, increasing to Ram, 3/16”, 6 oz., full-time.

22.5 Months
16th Visit
U/L: Maintained archwires with 15° of lingual crown torque L2-2 and CL II elastics.

23 Months
17th Visit
U: Removed TADs.
L: Performed IPR 2-2.

23.75 Months
18th Visit
U: Ligature-tied U3-3.
L: Adjusted brackets L2-2 for bite purposes.
U/L: Maintained archwires with 15° of lingual crown torque L2-2, CL II elastics (reduced to nighttime only) and power chain U/L 7-7.

24.25 Months
19th Visit
U: Added 15° of buccal crown torque to U3s and maintained ligature ties U3-3.
U/L: Maintained archwires with 15° of lingual crown torque L2-2, CL II elastics and power chain U/L 7-7.

25 Months
20th Visit
U: Added step-up bend to UR1, maintained ligature ties U3-3 and checked occlusion. Added k-ties U6s over 4s to post mesial to U3 on wire.
L: Added ligature ties L3-3.
U/L: Maintained archwires with 15° of lingual crown torque L2-2, CL II elastics and power chain U/L 7-7.

25.25 Months
21st Visit
U: Added step-down bends U2-2 to enhance smile arc and a closing spring to close L6 and 7.
L: Added step-down bend to LR3.
U/L: Maintained archwires with 15° of lingual crown torque L2-2, CL II elastics, ligature-ties U/L 3-3, power chain U/L 7-7 and k-ties.

25.5 Months
22nd Visit
U/L: Maintained archwires with 15° of lingual crown torque L2-2, CL II elastics, ligature ties U/L 3-3, power chain U/L 7-7 and k-ties. Took impression for lower permanent retainer.
25.75 Months
23rd Visit

U/L: Maintained archwires with 15° of labial crown torque L2-2 (adding step-up bend UR1), CL II elastics, ligature ties U/L 3-3, power chain under wires U/L 7-7 and k-ties.

26 Months
Final Visit, 110 Weeks
23 Treatment Appointments, 5 Emergency Visits, 2 Appliance Check Visits

U/L: Removed all appliances. Shaped and polished all the teeth. Took impressions for a muscle-training Damon Retention Splint (AOA, Sturtevant, WI).

U: Bonded permanent retainer U2-2, just on the 2s, starting at the UR2, shaping the wire tooth by tooth using .016 x .022 Bond-a-Braid™ lingual retainer wire (Reliance Orthodontic Products, Itasca, IL). If the upper fixed retainer comes loose after 18 months, we rebond only if the patient originally had 3 to 4 mm of spacing pretreatment.

L: Bonded permanent retainer L3-3, bonding each tooth using an .026 stainless steel wire, forming looping bends on each end. The lower fixed retainer is to be bonded for life.

26 Months - Treatment Complete
Retention Appliance Delivery

U/L: Delivered 1 mm clear Damon Retention Splint (AOA Lab, Sturtevant, WI). The Damon Retention Splint is excellent for retention of Class II cases and transverse arch development. The patient is to wear the splint full-time for the first 6 weeks and nighttime only thereafter.

Laser Contouring and Retention Checks

In the months subsequent to finishing fixed appliance treatment, performed laser contouring to correct gingival architecture: U2-2 and LR1. Two weeks after the final laser contouring, the tissue had healed and retention compliance was good only thereafter.

Posttreatment Retention

10 months
Retention compliance continues to be excellent. Space had opened between U1s. Patient wore retainers again and the space closed.
The patient is TMJ pain-free and is thrilled with her results that corrected the excessive gingival display without surgery. Overall, I accomplished all of my treatment goals except for going over in treatment time by 2 months.

This case was my first experience using this particular type of Class II corrector so I had not developed protocols for its use, which points up the value of such documentation in light of the errors that the assistants made. This case was also my first experience using TADs for intrusion and although the TAD treatment took longer than I had anticipated (almost 7 months), using them for intrusion worked well, precluding surgery.

In analyzing the cases of Dr. Dwight Damon and the arch form that he achieves, I discovered that keeping a .019 x .025 stainless steel archwire in the patient’s upper arch for six months or more is crucial to the result I hope to achieve. In this case, the stainless steel archwire remained in place for over 8 months to realize an excellent arch form. My ultimate goal is to manage cases so that I transition to the .019 x .025 stainless steel archwire at the 6-month juncture, then allow this finishing wire to work for another 6 months.

I find that taking photographs at regular junctures and using them to assess the case in the quiet of my office gives me vital information about torque, tip, tooth shape and occlusion that better informs my treatment going forward.

The gingival contouring I performed after the end of treatment further added to the esthetics of the result.

What I Would Do Differently Today

This case was a superb learning experience for me. The treatment would have been more efficient had the patient not had the Herbst issues. Since I wasn’t able to overcorrect the Class II to a Class III with the Herbst appliance, I had to fight relapse throughout treatment with elastics.

Because I hadn’t used low-torque brackets in the lower anteriors, I continually had to put lingual crown torque into the lower wire to overcome flaring. It also would have been beneficial to have had the +11° torque prescription for the U3s that the new Damon Q brackets offers versus the +7° of the D3MX prescription. It really goes to show how important variable torque is to our treatment.
Maxillary Hardware

Mandibular Hardware

Herbst/Elastics

Wire Sequence Chart

Clinician: Dr. Stuart Frost, Phoenix, AZ

Patient: S.M.
Class II dolichofacial female, age 22 years 11 months, presented with a bilateral cleft lip and palate, mobile premaxillary structures, anterior and posterior crossbites, narrow dental arches, severe crowding, and poor facial, dental and smile esthetics, which were secondary issues to the cleft lip and palate, resultant malocclusion and characteristic nasalized speech.

**Facial/Soft Tissue/Macroesthetics**
Convex profile with strong nasal projection and dorsal hump. Short chin and neck length and deficient pogonion. Long face, broad nasal tip, broad naries and poor cupid’s bow anatomy with a thick maxillary lip.

**Smile/Miniesthetics**
Symmetrical smile with low, inadequate incisal display, recessive upper lip and hypomobile lip curtain on full smile. Upper dental midline position off to patient’s right, severe crowding, narrow arches and inadequate dental display within buccal corridors.

**Teeth/Microesthetics**
Satisfactory tooth shade, overall dentition in good health with some restorations present, pegged maxillary left lateral incisor and a missing maxillary right lateral incisor. Gingival shape and contours reflect multiple lip and soft tissue repairs to cleft areas. The patient had had no osseous surgery. Super numerary teeth in cleft sites.

**Appliances Used**
- Damon® 2
- Quad Helix Appliance
Treatment Objectives and Plan

Attempt treatment via nonextraction therapy except for extraction of supernumerary teeth from cleft site and 3rd molars. The oral surgeon from the Department of Oral and Maxillofacial Surgery at the University of North Carolina at Chapel Hill recommended those extractions be completed at the time of the bone grafts to the cleft sites. Utilize a quad-helix appliance with wires extended anteriorly to the incisors to move the premaxilla and incisors out of crossbite. Employ passive self-ligation (Damon 2), developing arch widths to relieve crowding and improve the dental display in the buccal corridors—all in an effort to avoid exacerbation of the patient’s nasalized speech. Employ elastics (e.g., Class II elastics and box elastics) in the posterior to aid posterior occlusal settling. Anticipate that the fixed appliance treatment will create adequate space to align the dentition and correct the crossbites via arch development although the crossbites and skeletal components of the malocclusion may require orthognathic surgery for correction. Bone grafts to the cleft sites will stabilize the premaxilla. After orthodontic treatment, the restorative plan includes cosmetic surgery to improve the overall facial esthetics from the effects of the cleft lip and palate. The restorative plan will optimize smile esthetics and replace missing and malformed dentition.

Damon 2 Variable Torques Employed

- U1s: High torque (+17°)
- U2s: High torque (+10°)
- U3s: High torque (+7°)
- L2-2: Standard torque (-1°)
- L3s: High torque (+7°)
**Treatment Initiation**

Initially placed brackets only in the mandible (7-7), working to move the lower incisors facially and to facilitate movement of the premaxilla facially for eventual alignment with the maxillary incisors. Placed a quad helix appliance with anterior “whip springs” to the maxillary incisors to move the premaxilla and maxillary anterior teeth facially (out of crossbite) to be able to place the maxillary anterior brackets. Once the anterior occlusion could accommodate brackets, the quad-helix appliance would be removed and followed with placement of full maxillary appliances.

**25 Months**

After 11 weeks, removed the quad-helix appliance and replaced braces in the maxillary arch 7-7, then followed the typical Damon archwire sequence, extending the time of the .018 x .025 Damon Optimal Force Copper Ni-Ti® in the maxillary arch to nearly 8 months to aid its width development. Following arch development and exposure of the supernumerary teeth, the general dentist extracted them. One of the extracted teeth was used as a prosthetic tooth for the missing UR2 with the root of the supernumerary tooth amputated, a retro-crown endodontic procedure completed and the tooth filled with a composite restorative material. The UL2 was built up for tooth size coordination with the UR2 during treatment.

1All Copper Ni-Ti wire used is Damon Optimal Force Copper Ni-Ti.
29 Months
The UR1 and UL2 had inadequate bone along their root surfaces adjacent to the cleft sites and so were extracted during the maxillary arch bone grafts to stabilize the premaxilla. The extracted teeth would serve as pontics, placed on the archwire for the remainder of the treatment time. The planned advancement genioplasty was also accomplished at this time.
**30.5 Months**

**Final Visit, 130 weeks**

**15 Treatment Visits, 6 Emergency Visits**

Following appliance removal, fabricated a temporary partial appliance for the maxillary arch, anticipating that the patient would be undergoing treatment for implants (UR3, UR1 and UL2). Also placed a maxillary lingual arch cemented to the U6s with a temporary retainer placed over it (for day wear only). The dentist removed the lingual arch before completing the restorations. Retention for the mandible included a .027 TMA lingual arch bonded L3-3 and an Essix™ retainer (Dentsply Raintree Essix, Bradenton, FL) employed until the delivery of a removable Hawley retainer.

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**30.5 Months - Fixed Appliance Treatment Complete**
30.5 Months
Final Visit, 130 Weeks
15 Treatment Appointments, 6 Emergency Visits
Temporary Partial Appliance Placed
Restorative Temporaries Placed

30.5 Months Temporary Partial Appliance

30.5 Months Restorative Temporaries
The patient decided to forgo implants and have a fixed bridge instead. In an effort to improve stability of the transverse development without long-term retention and with my approval, the general dentist and patient decided to fabricate the maxillary fixed bridge 5-5. The restorative care would also enhance the maxillary incisal display by making an effort to create pleasing tooth shapes and a smile arc and by elongating the crowns to compensate for the hypomobile lip curtain on full smile. The patient understood that further soft tissue nasal and lip procedures are options for her to consider at her leisure for additional improvement of her facial and smile aesthetics.
Case Discussion

Accomplished all goals for functional occlusion (manipulated to coincident CR/CO) and prepared the dental arches for the patient to undergo restorative care. Achieved proper tooth inclinations and significant transverse changes in both dental arches with positive vertical and A/P changes as well.

Although the original treatment plan included maxillary orthognathic surgery to widen the maxilla, the orthodontic treatment alone was successful in fostering the arch development required. The only orthognathic surgery completed was advancement genioplasty to optimize mandibular projection and complement the facial A/P changes to improve the profile.

The patient's facial and smile esthetics would be further enhanced by planned lip and nasal plastic surgical procedures.

What I Would Do Differently Today

At the time I treated this case, I had no protocol for employing an expanded .016 x .025 stainless steel archwire for lateral development. Nor did I have protocols for using occlusal buildups to disocclude the dentition. Were I to treat this case today, I would start arch width development with the Damon recommended archwire protocol through the .018 x .025 CuNi-Ti archwire and then evaluate for use of a .016 x .025 stainless steel archwire expanded approximately 1 inch on each side to facilitate the arch development. When expanding an archwire for transverse development, it is important to evaluate crown torque and to consider adding posterior lingual crown torque to avoid excessive crown tipping. I would also have created occlusal buildups on the molar teeth using Triad Gel® (Dentsply, York, PA) and Transbond™ Plus Self-Etching Primer (3M/Unitek, Monrovia, CA) that would assist in bite opening and aid in expediting the posterior and anterior crossbite corrections.
placed this full-size wire (unusual for a Damon case) due to large span across anterior segment. Required some expansion because arches needed further coordination.

Placed Banded Quad Helix with anterior springs to the maxillary incisors to move them forward out of crossbite in order to place maxillary brackets.

Brackets repositioned so placed this archwire for 2 months.
Correction of Anterior Crossbite Due to Tooth Loss with Early Elastics

Clinician: Dr. Ramon Perera, Lleida, Spain
Patient: A.R.

Pretreatment Diagnosis

Skeletal Class I, dental Class III, female patient, age 32 years 6 months, presented to us for a second opinion. She was worried about her anterior crossbite due to previous extraction of her upper 1st bicuspids. Another orthodontist had recommended extracting two teeth from the lower arch, a recommendation she did not find acceptable.

Facial/Soft Tissue/Macroesthetics

Brachyfacial with normal facial heights and a good profile with a well-proportioned chin-to-nasolabial relationship. A slight lack of upper lip projection that was made more evident by a rather large nose. Full and slightly protruding lower lip due to the forward position and proinclination of the lower incisors. Thin and slightly recessive upper lip. Lack of midface support. Exposure of the lower incisors when the lips were in a relaxed position.

Smile/Miniesthetics

Symmetrical smile with a consonant smile arc. Little upper incisor display with no gingival exposure on smiling. Upper midline centered. Narrow smile (to the upper first bicuspids) without large buccal corridors. The esthetics of the smile is adversely affected by the presence of a large interincisal diastema.

Teeth/Microesthetics

Pleasing tooth shape, shade and gingival contours. Small contact areas between the central and lateral upper incisors with no black triangular holes. An absence of contact between the upper central incisors due to the diastema. Anterior crossbite due to the previous extraction of the upper 1st bicuspids. Proclination of the upper canines and lower incisors.

Appliance Used

Damon® 3MX
Dr. Ramon Perera | Class I & Class III Anterior Crossbite

Treatment Objectives and Plan

Employing Damon 3MX (D3MX) passive self-ligating appliances, achieve a functional occlusion, resolve the anterior crossbite and enhance facial and smile aesthetics by increasing the upper lip projection, upper incisor display and the smile width with exposure of the upper 2nd bicuspids on smiling.

Attempt to correct the malocclusion with Class III elastics, but if that plan does not prove possible, open space for implants in the maxilla. Discarded the option of lower extractions.

Employ low-torque brackets on the upper incisors to prevent the flaring of those teeth while using Class III elastics (or if we later choose to open maxillary space).

Damon 3MX
Variable Torques Employed

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Torque</th>
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</thead>
<tbody>
<tr>
<td>U1s</td>
<td>Low torque (+7°)</td>
</tr>
<tr>
<td>U2s</td>
<td>Low torque (+3°)</td>
</tr>
<tr>
<td>U3s</td>
<td>Standard torque (0°)</td>
</tr>
<tr>
<td>L1-2</td>
<td>Low torque (-6°)</td>
</tr>
<tr>
<td>L3s</td>
<td>Super torque (+7°)</td>
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</tbody>
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Treatment Sequence

Bonding

U/L: Direct-bonded U/L 6-6, engaging .014 round Damon Optimal Force Copper Ni-Ti® archwires, cutting the wire distal to the 6s. Bonded posterior bite planes using Resilience® blue light-cure band cement (Ortho Technology, Tampa, FL) on the U6s to disarticulate the arches and facilitate the work of the CL III elastics. (If we were to treat this case today, we would fit bite turbos on the lingual surfaces of the L1s.) Started Quail, 3/16", 2 oz., Shorty CL III elastics (bilaterally L3 to U5, full-time). Placed stops mesial and distal to UR1 and LL1. In cases with an interincisal diastema, it is not recommended to put both stops between the U1s.

Bonding

1All Copper Ni-Ti wire used is Damon Optimal Force Copper Ni-Ti.
2.5 Months

**U/L:** Bonded the 7s, extending the wires to them. Maintained the Shorty CL III elastics, but advanced to Otter, 3/16”, 3 oz., bilaterally L3 to U5, full-time.

**U:** Transitioned to .016 CuNi-Ti, moving the stops mesial and distal to UR3. Normally, when there is no crowding, we fit the stops mesial and distal to a bicuspid (not the cuspids).

**L:** Transitioned to .014 x .025 CuNi-Ti archwire in the lower arch, maintaining the stops mesial and distal LL1.

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5 Months

**U:** Transitioned to .018 x .025 CuNi-Ti archwire, placed power chain U3-3 and moved stops mesial and distal to UR5.

**L:** Initiated slight IPR L2-2 to improve their contact areas, placed one stop between the L1s and placed power chain L3-3, but towards the occlusal edge (over the 1s and 2s) to achieve a greater retroclination effect. Maintained the .014 x .025 CuNi-Ti archwire.

**U/L:** Transitioned to full Class III elastics full-time, bilaterally, Kangaroo, 3/16”, 4.5 oz. Even though we moved from Shorty to full Class III elastics, we continued the same length elastics (3/16”) because, with the absence of the U4s, there had been too much slack in the elastics so they did not produce the desired effect.
6.5 Months

U: Maintained .018 x .025 CuNi-Ti archwire, moving stops mesial and distal to UL5.

L: Transitioned to a .018 x .025 CuNi-Ti archwire, moved the stops mesial and distal to LR5 and renewed the power chain L3-3, again fitting it toward the incisal edges.

U/L: At this appointment, we were pleased to see the positive effects of the Class III elastics over the previous 1.5 months, which confirmed that in the first 5 months of treatment, the elastics had not had the desired effect because the length was too great given the absence of the extracted teeth. Maintained the full Class III elastics, full-time.

6.5 Months
9 Months

U/L: Took an interim panograph and rebonded UR7, UR2, UL1, UL5, LL5 and LL7. Maintained the .018 x .025 CuNi-Ti archwires, the stops (mesial and distal to UR5 and LR5) and ligature-tied U/L3-3. Maintained the full Class III elastics full-time. At this point, the Class III is corrected and the facial esthetics have improved (upper lip projection, smile width, midface support, etc.).
10.5 Months

**U/L:** Transitioned to preposted .019 x .025 stainless steel archwires, fitting tie-backs to keep the posterior spaces closed (L6 over 4 to post mesial to L3 and U6 under 5 to post mesial to U3), widening the upper archwire (standard Damon arch form) 5 mm in the posterior bilaterally. Added tip-backs in the upper and lower molar regions to prevent molar extrusion. Continued ligation U/L 3-3 and Class III elastics, transitioning to Impala, 3/16”, 6 oz., full-time.

12 Months

**U:** Maintained the .019 x .025 stainless steel archwire with the posterior expansion and tip-backs, ligation U3-3 and the tie-backs in the buccal segments.

**L:** Transitioned to a .016 x 025 stainless steel wire on the lower arch to facilitate intercuspation. Transitioned to Moose elastics, 5/16”, 6 oz. in a tent configuration (L4 to post mesial to U3 to post mesial to L3) full-time, to stabilize the Class I relationship and close the bite. Maintained the ligation L3-3 and tie-backs in the buccal segments.
15 Months

U: Performed additional IPR on the incisors to improve the contact areas. Transitioned to .019 x .025 purple TMA archwire, adding labial root torque to the UR3, bending the wire distal to the 7s. Engaged power chain U6-6. We used the low-friction TMA archwire because of the IPR.

L: Transitioned to a .017 x .025 TMA archwire. There were no spaces on the lower arch so it was not necessary to use a power chain for space closure; however, because it was not possible to bend the lower archwire on the distal side (note the stops mesial and distal to LR5), I used a power chain L6-6 to prevent new spaces from opening.

U/L: Began 1/8”, 6 oz. triangular finishing elastics (Ceosa Orthodontic Manufacturing, Madrid, Spain) on the canines (U3 to L3 and L4) and bicuspids (U5 to L4 and L5) and Impala 3/16”, 6 oz. posterior box elastics on the molars (U6 and U7 to L6 and L7), full-time.

16 Months

U/L: Maintained archwires, power chain and elastics attachments.
17 Months
Final Visit, 68 Weeks
11 Treatment Visits, 2 Emergency Visits

U/L: Removed all appliances. Direct bonded fixed permanent retainers U2-2 and L3-3, using Ortho FlexTech™ gold chain (Reliance Orthodontics, Itasca, IL) and took impressions for a Damon Retention Splint (AOA, Sturtevant, WI) to be worn at night for one year.
We achieved all the primary treatment goals. With the correction of the anterior crossbite, the patient now has a functional occlusion and her facial and smile esthetics have improved (improved upper lip projection, increased smile width and exposure of the 2nd bicuspids on smiling).

Thanks to the power of early elastics, the Class III canine relationship and the anterior crossbite were corrected without opening any space on the upper arch or having to extract on the lower arch. Generally speaking, it is very important to use extremely light forces with nickel-titanium archwires. In this case, after nine months of treatment with early elastics, we already knew that the space opening on the upper arch would not be necessary. If we had not used elastics from the beginning, we would have had to spend much more time in the stainless steel archwire phase, and if Class III elastics had not been adequate, we would have had to begin opening space for upper bicuspids after one year of treatment or more.

If lower arch extractions had been the treatment choice, the result would have been far less attractive and the patient’s facial aesthetics would have been compromised. We would have reduced her lower lip instead of increasing the projection of her upper lip, which would have left her entire profile more retruded. Particularly in this case, such retrusion would have been accentuated by the prominence of the patient’s large nose.

We bonded low-torque brackets on the upper incisors because either of the two possible treatment options (Class III elastics or space opening on the upper arch) would have resulted in proclination of the incisors, which the low-torque brackets would have served to mitigate or even preclude.

We bonded low-torque brackets on the lower incisors (-6°) because we were not sure that we could correct the malocclusion using only Class III elastics (due to potential space opening on upper arch) and because the lower incisors were already proclined at the start of the treatment.

Had we treated this case later using the Damon Q™ (DQ) appliance, we would probably have bonded standard torque on the lower incisors (-3°) because low torque (-11°) would have been excessive in this case since there was no crowding on the lower arch. We would then have used Class III elastics. If we had treated the case by opening space on the upper arch (without using Class III elastics), DQ low-torque brackets would have been the appropriate choice.

The Damon System appliance offers a variety of different torque options. It is important to carefully select the required torque based on a number of parameters: (1) The initial position of the tooth and (2) The nature of the malocclusion and how it must be resolved (e.g., if it is necessary to use Class II or Class III elastics, whether there is crowding and how severe it is, if it is necessary to align the curve of the Spee and if there will be extractions, etc.). If we do not apply the correct bracket torque, the treatment will take longer because we will have to resolve torque problems that we ourselves have caused.

We regard the stainless steel archwire phase as finished when all the anterior-posterior, transverse and vertical problems have been resolved. After that, the only remaining work is to improve the intercuspatation and, if necessary, to add individual tooth torque refinements and/or insets and offsets to the archwires. For this reason, we do not think that it is typically necessary to continue stainless steel archwires for an extended period of time.
**What I Would Do Differently Today**

Despite bonding standard torque brackets on the upper canines (0°), their initial proclination and the use of Class III elastics mandated that we apply labial root torque to the TMA archwire at the UR3. Were I to treat the case today, I would use the DQ standard-torque brackets (+7°) on these teeth because low-torque brackets (-9°) would be excessive. We would probably, however, have to invert the brackets (-7°) either before or after the stainless steel archwire phase in order to correct the upper canine proclination.

I also think that we should have extruded the upper incisors a little more, thereby increasing their exposure on smile and improving the smile arc. We should also have intruded the lower incisors to minimize their exposure when the mouth is in a relaxed position.

I would like to thank my collaborator, Dr. Jessica García, for all the help she has given me in the treatment of this patient, the selection of the photographs and the preparation of the case report.
### Damon Archwire Sequence

#### PHASE I
**INITIAL LIGHT ROUND WIRES**

<table>
<thead>
<tr>
<th>Archwire</th>
<th>Duration</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>.014 Damon Copper Ni-Ti* (U/L)</td>
<td>10-20 Weeks</td>
<td>• Level and align.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Initiate arch development.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Resolve 90% of rotations.</td>
</tr>
<tr>
<td>.018 Damon Copper Ni-Ti (U/L)</td>
<td>6-8 Weeks</td>
<td>• Continue to level and align.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Continue arch development.</td>
</tr>
</tbody>
</table>

#### PHASE II
**HIGH-TECHNOLOGY EDGewise WIRES**

<table>
<thead>
<tr>
<th>Archwire</th>
<th>Duration</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>.014 x .025 Damon Copper Ni-Ti (U/L)</td>
<td>10-20 Weeks</td>
<td>• Resolve remaining rotations.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Complete leveling and aligning.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Begin torque control and anterior space consolidation.</td>
</tr>
<tr>
<td>.018 x .025 Damon Copper Ni-Ti (U)</td>
<td>4-6 Weeks</td>
<td>• Continue arch development (without the assistance of RPEs or W-arches).</td>
</tr>
<tr>
<td>(.017 x .025 or .019 x .025 Damon Reverse Curve Ni-Ti is often used in deep-bite, div. 2 cases)</td>
<td></td>
<td>• Express additional torque control as needed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Continue anterior space consolidation and arch development.</td>
</tr>
</tbody>
</table>

#### PHASE III
**MAJOR MECHANICS**

<table>
<thead>
<tr>
<th>Archwire</th>
<th>Duration</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posted stainless steel .019 x .025 (U/L)</td>
<td>20-30 Weeks</td>
<td>• Finish torque control.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Consolidate posterior space.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Adjust buccal/lingual and A/P.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Coordinate patient-specific arch form.</td>
</tr>
</tbody>
</table>

#### PHASE IV
**FINISHING**

<table>
<thead>
<tr>
<th>Archwire</th>
<th>Duration</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posted stainless steel .019 x .025 (U/L)</td>
<td>10 Weeks</td>
<td>• Final detailing as necessary.</td>
</tr>
</tbody>
</table>

*As suggested by Dr. Damon when using Damon System braces and treatment protocols to treat nonextraction cases with mild to moderate crowding. Individual patient responses may vary and be influenced by age, gender, patient compliance, etc.*