**JCO INTERVIEWS**

**Dwight Damon, DDS, MSD**

**DR. KEIM** How did you become so interested in orthodontic research and development?

**DR. DAMON** My father was an outstanding science teacher and deserves the credit for always encouraging me to be curious and not be afraid to ask, “Is there a better way?” This led to my interest in research and being involved in two vascular research studies at King County Hospital during my dental-school years in Seattle. I was also very fortunate to spend my earlier college summer years working in a machine shop, learning to fabricate and work with metals.

**DR. KEIM** What prompted you to develop a self-ligating bracket system?

**DR. DAMON** I have always been very motivated to keep learning and improving how I was treating and caring for my patients. Early in my career, I questioned why force levels for clinical mechanics were based on patient tolerance rather than their positive or negative impacts on bone and tissue. It seemed that if teeth did not move, most clinicians’ solutions were to increase the applied force.

With some of the lessons learned from my summer research, I was fascinated by how little force or pressure it took in some tissues to interrupt vascular supply. Even though the mechanism for tooth movement is still not totally understood, it has always made sense to me that maintaining vascular supply to alveolar bone and tissues has to have a positive impact on tooth movement and bone and tissue responses. I also observed that there was a significant difference in clinical responses when tying initial light-force archwires with elastomers vs. loosely tied wire ligatures. Obviously, the archwire has to slide through the brackets to allow teeth to move and align. It simply made sense to start cases with very light-force archwires that were allowed to express themselves in a reduced friction and binding environment of the archwire-bracket interface. There is a misunderstanding in our profession about the role played by friction and binding in the performance of clinical mechanics.

I tested my theory on typodonts and found there was a significant difference between the two tying methods in the amount of force it took to slide an archwire through irregularly positioned bracket slots. Taking the next step, I cut bracket-size .022” × .028” tubes and bonded them to irregularly positioned lower anterior teeth on a typodont and was impressed with how much less force it took to slide the archwire through tubes vs. those archwires that were tightly tied with elastomers or wire ligature ties. I tested my theory clinically by bonding bracket-size tubes on a very crowded lower arch of a close friend and was astonished at the clinical response when using small-dimension light-force archwires.

It was also obvious that our office spent most
of the day removing and inserting archwires. It only made sense that there was a significant need for an easier and quicker way to accomplish this task. I tried two of the self-ligating brackets in the marketplace at the time, but soon found that I didn’t want to give up the twin-bracket configuration. I also desired to take advantage of low-force sliding mechanics in a tube configuration that I had previously tested.

**DR. KEIM** How did you then develop the Damon* appliance?

**DR. DAMON** I started drawing passive self-ligating brackets in the late 1980s. Due to limitations in manufacturing technology, it was challenging to design small brackets that included very small moving parts. The first manufactured Damon bracket body was cast, but the opening and closing slide was stamped, which made it difficult to control fit and performance. I bonded my first patient with the first Damon passive self-ligation bracket in 1993. Even though there were significant clinical issues with reliability, it was obvious that this technology had tremendous potential for improving clinical performance; it seemed like it could be a significant step forward for patient care.

The big manufacturing breakthrough came when injection molding came to orthodontics. This allowed significant freedom for bracket design and dramatically improved bracket fit, contours, reliability, and performance.

**DR. KEIM** What has changed with the Damon System since JCO’s first article was published in 1998?

**DR. DAMON** Many changes have occurred since then:
- The addition of archwire choices to improve clinical performance with increased opportunities for gradual archwire progressions.
- The use of bite turbos and very light early elastics.
- Treatment planning for protecting a desirable smile arc.
- The use of temporary anchorage devices (TADs).
- The use of Damon Splints in retention of severe anteroposterior and buccolingual posterior corrections.

The most significant change has come in the area of improved torque control. Since the development of straightwire orthodontics, many clinicians have assumed they have torque control utilizing only one bracket torque prescription on each anterior tooth. Unfortunately, without bending edge-

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wise archwires to individualize finishing torque, selecting only standard torque for each tooth has nearly the same effect as treating cases using only round archwires. For example, if an .019” × .025” stainless steel working or finishing archwire is placed in an .022” slot, there is approximately 11-12° of play in either direction, for a total of 22-24° of play before a “torquing couple” is achieved between two opposite corners of the edgewise archwire and the opposing walls of the bracket slot (Fig. 1). Some clinicians have tried to fill the archwire slot with larger-dimension rectangular archwires to achieve torque control, but many have found it difficult to finish and detail cases due to binding and friction in the archwire-bracket interface (Fig. 2).

To illustrate the equivalent impact of this significant archwire play, I don’t think many clinicians would be happy finishing cases where the teeth are rotated or tipped 11-12° out of proper alignment in either direction. Unless each tooth is detailed by bending final torque into edgewise archwires to express a torquing couple in each bracket slot, basically the clinician is producing the equivalent of “round-wire orthodontics”! What can be deceiving is that approximately 40% of treated cases—even those demonstrating extreme crowding—can achieve outstanding finished results when the pretreatment root apices are properly aligned, allowing proper clinical tooth positions to be achieved by simply tipping one tooth against another while utilizing the equivalent of round-wire orthodontics. Roughly the next 40% of cases have root apices slightly out of position; when treated with the same archwire sequencing, they show finished results that are acceptable, but not to the same standard unless significant time is spent bending and detailing individual torque. The last 20%, in which initial root apices—particularly in the upper arch—are significantly out of line, turn out to be the challenging cases that consume substantial clinical hours in trying to overcome lack of torque control.

When visiting offices, I have often seen clinicians trying to finish cases by stepping archwires in-out or up-down when torque control is the real issue (Fig. 3). What we have engineered into the Damon Q and Damon Clear passive self-ligating bracket systems will help overcome many of these issues by providing bracket torque options with either high or low torque couples that are gradually expressed as the clinician works through edgewise archwire progressions. If clinicians will take a few minutes to plan “torquing couples” for each anterior tooth on every patient, outstanding finishes will be far easier to achieve.

DR. KEIM How is this done?

DR. DAMON It is critically important to place brackets in the recommended vertical position on
the upper central and lateral incisors (near the mid-vertical tooth position, depending on the smile arc,\(^2\) Fig. 4) to take advantage of the torquing couples that are engineered into the brackets. Moving bracket placement vertically in either direction from this bracket-engineered position can have a profound impact on changing torque values. We recommend placing the upper canine bracket at the height of the labial contour. The smile arc is impacted by the angle of the occlusal plane and the vertical bracket position on the central and lateral incisors relative to the standard canine bracket position.

For many years, the recommended archwire sequencing of the Damon System has provided initial “biologically sensible” forces to help with initial tooth and arch aligning. Now, by utilizing high and low bracket torquing couples, gradual torque expression can be achieved with the recommended edgewise archwire progressions, resulting in a positive impact on bone, tissue, and treatment times (Fig. 5). I truly believe that moving from just one standard torque for each anterior tooth to selecting either high or low bracket torquing couples is the next significant advancement to help improve clinical mechanics and treatment results (Fig. 6).

To summarize, the advantages we have seen with “Holding Bracket Torquing Couples” are:
- Final facial inclination is achieved with minimal or no bending of the edgewise archwire.
- Torque is gradually expressed as larger-dimension archwires are inserted.
- With outstanding clinical management, treatment time can be reduced.

**DR. KEIM** What didn’t work in early versions of the Damon System?

**DR. DAMON** In the early and mid-1990s, there were significant reliability issues with slides, brackets, and bond failures in the first and second iterations of the Damon and Damon Mini brackets. Significant progress was made with the introduction of Damon 2 in the late ’90s. The first attempt at manufacturing a more aesthetic (partially composite) Damon 3 bracket met with wearing and strength issues. Today the metal Damon Q has come a long way, with very reliable clinical performance. It is so encouraging to hear clinicians all over the world say how pleased they are with the size, smoothness, performance, and robustness of the Damon Q passive self-ligating bracket. Damon
Clear, also a passive self-ligating bracket, has recently been introduced for clinicians desiring an esthetic option.

**DR. KEIM** How would you describe the Damon appliance system today?

**DR. DAMON** All brackets designed and brought to the marketplace for the Damon System have featured passive self-ligation. What has been so important to its success is that it has not been just a bracket, but a carefully designed system utilizing specific archwire progressions to enhance clinical management of lighter-force mechanics (Table 1). Many clinicians feel that by utilizing lighter-force, lower-friction mechanics, they see a positive impact on bone and tissue, with more treatment-planning options for the maturing adult face.

**DR. KEIM** What are the differences among the various versions of the Damon System?

**DR. DAMON** There are two passive self-ligation brackets for the Damon System: Damon Q and Damon Clear. Passive self-ligation brackets and early light-force, high-technology archwires are the heart and soul of the system. The passive self-ligation part of the bracket has also been selected for Insignia.* There is very little difference between these three systems, except that Insignia has its own computerized bracket-placement jigs and its manufactured torque is computer driven.

Damon Clear does not have a second horizontal archwire slot, but has just recently introduced new torque-coupling options. As with any ceramic bracket, special care must be taken in its handling, particularly during bracket removal, and archwire sequencing should be sensitive to the nature of ceramics. Auxiliary appliances are the same for all Damon brackets.

**DR. KEIM** What are the advantages of a self-

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Fig. 6 Proper axial tooth inclination achieved using correct bracket torquing couples, with minimal or no bending of finishing edgewise archwires. A. 22° torque in maxillary central incisor bracket produces positive torque. B. 2° torque in maxillary central incisor bracket produces upright tooth position. C. 2°- and 22°-torque brackets and .019“ x .025” archwire allow correction of severe division 1 and 2 axial inclinations, respectively.
ligating system in terms of mechanics, biology, and treatment efficiency?

DR. DAMON This is difficult to answer briefly because the advantages for the clinician are numerous. If the goal of any clinician is to use clinical mechanics that produce more “wanted forces” than “unwanted forces”, then self-ligation is a significant step forward to achieve these goals. The in vitro Orthodontic Simulator (OSIM) studies done by Dr. Hisham Badawi at the University of Alberta clearly substantiate the significant mechanical advantages of self-ligation over conventional mechanics. The expression of early light-force archwires produces far different forces and moments, both in magnitude and direction. Dr. Badawi found more wanted forces and fewer unwanted forces with passive self-ligation than with conventional ligation, which allows the clinician more opportunities to treat patients without extractions.

More than 4 million patients have now been treated worldwide with the Damon System, and the evidence strongly supports a positive impact on bone, tissue, and facial outcomes. Biological advantages are hard to substantiate with research, but I think the most compelling evidence is what experienced clinicians see day after day in their practices. Many clinicians comment on the positive tissue and bone responses they are seeing, even in periodontally compromised patients. The management decision to bring Insignia to the marketplace as a passive self-ligating bracket speaks strongly for passive self-ligation.

Regarding treatment efficiency, appointment intervals can be lengthened early in treatment to allow time for the “biologically sensible” light forces to express themselves. Research studies show, and many clinicians worldwide have seen, a decline in both their number of appointments per patient and treatment times. I also hear many clinicians mentioning that early lightwire alignment happens in less time, giving the clinician more time to detail and finish. However, I want to make it very clear that case management varies greatly from office to office and has a major impact on treatment efficiencies. For this reason, my focus in lecturing for the past 10 years has not been on the speed of treatment or the decrease in the number of appointments, but rather on how and why this technology expands treatment options and, in my judgment, improves the quality of patient care.

One of the management impacts of this technology is to unload the schedule and help patient flow due to how quickly archwires can be changed. For those clinicians with excellent case management, research has shown that the number of appointments is often decreased and treatment time shortened. Chairside assistants become proficient in handling archwires very quickly. It is a good feeling to leave the office at night knowing that every archwire on every patient is fully engaged in the bracket slots. Thanks to the ease of getting archwires in and out, the clinician has the opportunity to accomplish every desired task at every appointment without upsetting the schedule.

DR. KEIM What are the disadvantages of self-ligation?

DR. DAMON I think the most challenging aspect for some clinicians is that they view passive self-ligation as “just another bracket” and use their traditional archwire sequencing and clinical mechanics with disappointing results. Case management in the early phases of treatment is absolutely critical to take advantage of low-force/high-technology archwires in a lower-friction bracket-slot environment. I sometimes hear clinicians say, “I use the same archwire sequencing in my conventional brackets; what is the difference?” What they don’t realize is that the same light high-tech archwire can have a significantly different response (more “unwanted forces” for the clinician to overcome) with the presence of friction in the bracket-archwire interface.

DR. KEIM How does the cost of a self-ligating bracket system compare to that of a traditional bracket system?

DR. DAMON While the initial price for any self-
ligation bracket is more than that of traditional brackets, the benefits far outweigh the cost, with longer appointment intervals and fewer auxiliary appliances and extractions; with outstanding case management, many clinicians have also found faster treatment times. My decisions on what technology to use in my clinic have always been based on what I perceived would help deliver the best quality of care for my patients. There is no question that self-ligation has dramatically improved my chances of meeting my challenging goal: “Straight teeth should never come at a long-term high cost to the periodontium or the face.”

DR. KEIM How does the bond-failure rate compare between conventional bracket systems and the Damon System?

DR. DAMON Speaking with clinicians all over the world, I hear the bond-failure rate of the Damon Q is about the same as with conventional systems. This was not true of the early versions of passive self-ligating brackets, which were significantly larger in size and more susceptible to bond failure. Quite frankly, with outstanding bonding technique, the bond-failure issue has changed from a question of failure rate to one of the increasing challenge to remove brackets at the time of debonding.

Today, the cements in the marketplace are so excellent that if proper bonding procedures are

TABLE 1
DAMON SYSTEM MECHANICS

Archform
**Initial:** Start tooth movement, rotation control, leveling, and alignment; prepare for high-tech edgewise phase.
- .014” Copper NiTi*, with segmental .012” or .013” Copper NiTi in second horizontal slot of Damon Q bracket as needed.
- .018” Copper NiTi. Very light elastics can be started.

**High-Tech Edgewise:** Continue alignment and root tipping, gradually start working on torque, complete rotation control, consolidate space in anterior segments, and prepare for major-mechanics phase.
- .014” × .025” Copper NiTi.
- .018” × .025” Copper NiTi: Excellent archwire to prepare for insertion of stainless steel major-mechanics archwire. In most cases, appointment interval should be shortened to four to eight weeks due to wire’s strong influence on archform, with one exception—bilateral posterior crossbites. Special situations may call for TMA* archwires.

Major Mechanics
Control vertical and buccolingual dimensions while closing spaces, use stronger elastics (if needed) for anteroposterior dental correction, and adjust posterior buccolingual discrepancies.
- .019” × .025” stainless steel (pre-posted): Excellent archwire to maintain arch integrity during anteroposterior correction and space closure in both arches.
- .016” × .025” stainless steel (pre-posted): Can be used in lower arch when more play is desired after appropriate torque control has been achieved.

Finishing
If initial bracket torquing couples have been selected prior to treatment, adjustments and torque requirements should be minimal; major-mechanics archwires can usually be used to complete treatment. If additional moderate bends and torque are required, .017” × .025” or .019” × .025” TMA archwires should be used.

Auxiliary Appliances
Herbst** appliance is an important part of skeletal Class II correction; low-force W-arches are used for posterior crossbite correction in early mixed dentition. Temporary anchorage devices, very light early elastics, and Damon Splints are also integral components of Damon System.

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carefully followed, failures should be minimal. My points of emphasis have always been to have meticulous tooth preparation, then keep the tooth surface impeccably dry, followed by minimal application of pre-seal (if used), making certain the cement is pressed into the pad and wiping off any excess prior to placement. It is absolutely critical to place the bracket as close as possible to the final position with minimal “dancing” or moving. I have always tried to place the appropriate amount of cement on the pad, so that excess is rarely required to be removed, preventing “bracket dancing” prior to light activation. Simply put, the more you move a bracket prior to light activation, the greater the chance for bonding failure!

DR. KEIM How would you describe frictional resistance relative to the Damon System?

DR. DAMON Over the past decade, there have been several well-documented studies done on relative frictional resistance in self-ligating vs. non-self-ligating systems. I think this question can be best answered by quoting Dr. Badawi (now a practicing orthodontist in Calgary, with a PhD in orthodontics), the developer of the OSIM machine that allows new research on clinical forces and mechanics at the University of Alberta: “Perhaps the most revealing initial finding with OSIM is that no orthodontic force system is ‘perfect’. All deliver forces that are both ‘wanted’ or ‘unwanted’ in terms of force levels and moments. The goal of the orthodontic clinician should be to take full advantage of wanted forces while mitigating against unwanted forces in planning treatment mechanics.” The group at the University of Alberta found that passive self-ligation, with appropriate case management, has significant mechanical advantages over all other treatment systems.

DR. KEIM Some studies have indicated that the “binding and release” phenomenon is more important than frictional resistance in determining treatment efficiency. How does this apply to the Damon System?

DR. DAMON I think this very good question can best be answered by responding to an article published by Dr. Jack Burrow. To quote part of the abstract, “Despite the emphasis it now receives in the marketing of self-ligating brackets, friction is not the major component of resistance to sliding in clinical treatment. Clinical studies support the view that resistance to bodily tooth movement by sliding has little to do with friction and, instead, is largely a binding-and-release phenomenon that is about the same with conventional and self-ligating brackets.” I recommend that every orthodontist read this paper carefully, since the above conclusion is based on tipping a bracket up to 13° relative to an .021" × .025" stainless steel wire and reporting on the resulting resistance to sliding—which obviously consists of predominantly binding and little friction. This use of .021" × .025" stainless steel is a hypothetical but clinically irrelevant and impossible clinical scenario. A more clinically useful setup is provided by Dr. Badawi’s research, in which they used a light aligning archwire and assessed the overall force system, not just the frictional forces. In fact, discerning readers will find that Dr. Burrow refers to data by Kusy and Articolo showing that for .021" × .025" NiTi* and .021" × .025" TMA* wires placed at a more reasonable 3° of tip, the binding percentages were 45% and 35%, the remaining resistance to sliding being friction at 55% and 65%, respectively. What I also find interesting in Dr. Burrow’s paper is that in utilizing small round wires (.014", for example), friction (not binding) constitutes more than 95% of the total resistance to sliding, and that is exactly why low-friction passive ligation is more efficient than conventional ligation during the alignment phase. By the time rectangular wires are introduced, there are very small slot-to-wire angulations that do not produce the binding levels mentioned in the article. Burrow refers to the previous study by Articolo and Kusy: “They noted that the binding influence became greater as the wire-bracket angulation increased. With a 7° angulation, the binding made up 80% of the resistance to sliding; when the angle was increased to 13°,

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binding produced 99% of the resistance to sliding, and friction was not an influence. This data is for full-size wires (.021" × .025" stainless steel, nickel titanium, and beta titanium). It is simply not possible in real life to use the tested full-size wires at such angulations. These types of bracket angulations only permit the use of small round wires, which produce very low binding, and only produce significant friction with conventional ligation.

**DR. KEIM** How does the passive Damon System compare to active self-ligating systems?

**DR. DAMON** In my lectures, I have always encouraged clinicians to take advantage of improved mechanics by changing to active or passive self-ligation from conventional mechanics. I have pointed out that if high-technology archwires were not available today, I would recommend that active self-ligation be used to take advantage of the flexibility of the clip to enable lower clinical force expression of the archwires. With the availability of high-technology archwires, however, research has shown that passive self-ligation has significant advantages for the clinician because it has the most effective force expression throughout the recommended archwire progression. “Effective force” means that combination of archwires and low-ligation-force brackets that produces the most appropriate force to create the greatest tooth and alveolar-bone movement with the resultant force expression in the desired direction. With the clip extending into the slot of an active self-ligation bracket, the frictional forces are higher—particularly in the lower anterior area, where interbracket distances are very small and even initial light-force archwires can exhibit higher friction and thus impact force expression. I have found it easier to convert anterior crowding into an increase in posterior transverse width with the larger slot lumen of passive self-ligation. Some clinicians use active self-ligation because they have been told there is better torque control, but recent research has shown that active self-ligation, passive self-ligation, and conventional brackets all express the same amount of effective torque control.8

**DR. KEIM** What are the advantages of arch development over extraction?

**DR. DAMON** I think I can best answer this question by first discussing why I saw a need to change my clinical mechanics and treatment planning. When I first started my practice in 1970, records show that I was extracting in nearly seven out of 10 patients. Please remember, in those days, treatment planning was impacted by the need to gain 6–8mm of space just for band material alone. I always tried to carefully treat to the original lower archform and diligently equilibrate the final occlusions of all my patients. At that time, normal retention procedures were to retain upper and lower arches for at least two years, and then retention was removed. In the late 1970s, I started to see retention relapse in a significant number of my patients. I felt I must be doing something wrong! I decided to spend many of my weekends at the University of Washington Orthodontic Department in Seattle carefully evaluating the long-term treatment outcomes on over 600 patients more than 20 years out of treatment, collected under the guidance of the department chairman, Dr. Richard Riedel. These patients (both extraction and non-extraction) had the same stability issues I was seeing in my own patients. In my opinion, many of these patients had flattened facial profiles, particularly in extraction cases. I also observed that extraction patients appeared to have more long-term periodontal issues.

My take-away from studying these patients: It was apparent that I needed to place permanent retention in the lower 3-3 area on all my patients, whether extraction or nonextraction. I then concluded that if permanent lower anterior retention was necessary, why not start planning more non-extraction treatment with the 50-year-old face in mind?

Getting back to your original question, the advantages of arch development over extraction cases are:
- It has a positive impact on the midface and facial profile.

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It usually requires less tooth movement, which appears to have a positive long-term impact on the periodontium.

I have observed a positive impact on tongue position and airway in many of my patients.

Increased posterior width in the upper and lower arches is achieved by transverse bodily movement of the upper posterior teeth along with uprighting of the lower posterior segments, allowing the clinician to establish the appropriate transverse curve or curve of Wilson with positive excursive occlusion.

I want to make it very clear that I still strongly support extractions in those patients who have adequate posterior arch width and exhibit severe bimaxillary protrusive dentitions and profiles!

**DR. KEIM** Is stability still a concern in non-extraction arch-development cases?

**DR. DAMON** Let’s be honest: stability is always a concern, no matter what type of treatment planning and mechanics are utilized. This statement is substantiated by the outstanding research done by Dr. Robert Little, a classmate of mine who evaluated the 600 long-term retention patients mentioned above at the University of Washington. Of these extraction and nonextraction patients, who had been treated with conventional mechanics, only 20% were “stable” 10 years post-treatment. Twenty years post-treatment, only 10% were “stable”. What has been hard for me to understand is why many in our profession still seem to support these astonishing results as the standard for patient care and treatment planning.

I spent a great deal of time in the late ‘70s and early ‘80s looking for clinical techniques that would help create greater long-term stability than what I was producing. To me, the most stable results ever achieved in clinical orthodontics were those developed by Dr. Fränkel. What Fränkel did with his removable appliances was to take the muscles of the face and tongue out of play and let teeth seek their new positions without this muscular influence. I have evaluated the results on several hundred Fränkel patients and have been impressed with the increase in posterior width over time, followed by remarkable long-term stability post-treatment. What I want to point out is that the archform consistently produced post-Fränkel treatment has been the basis for the Damon Archform. My goal has been to achieve the same long-term stability with the Damon System that Dr. Fränkel achieved using removable appliances.

The profession, quite correctly, has always viewed lower posterior arch-width increases with skepticism. The real question is if there is a resultant difference between creating posterior width changes with the old techniques, utilizing higher forces over a short time, vs. those lower-force/lower-friction forces of the Damon System—which are more in line with those created by Dr. Fränkel’s techniques.

**DR. KEIM** Are there long-term follow-up studies regarding stability of arch expansion using the Damon system?

**DR. DAMON** After treating all of my patients with passive self-ligation for more than a decade and carefully evaluating treatment outcomes, I started collecting data in the early and mid-2000s in three areas of interest:

- A long-term follow-up stability study regarding posterior width changes in crowded patients treated with the Damon System protocol.
- A follow-up evaluation of the long-term impact on alveolar bone post-treatment, carried out in 20 patients using medical computed-tomography scans (the only option for CT scans in the early 2000s). Several of the medical CT scans were published in the 2005 edition of the textbook by Graber, Vanarsdall, and Vig. A patient from this study, shown in Figure 7, was treated with the early Damon brackets introduced in 1993. My reluctance to even treat this patient, let alone treat nonextraction, was based on many years of utilizing conventional mechanics and treatment planning. Due to family circumstances and patient health issues, there were strong reasons to consider treating nonextraction. I collaborated with a local periodontist prior to and during treatment, and the final treatment impact on bone, tissue, and

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the face was my wake-up call that this new technology had the potential to expand future treatment-planning options. Please carefully note the long-term impact on bone and tissue by observing the photographs and medical CT scans. Also note the posterior stability more than four years following any posterior retention.

- Later, I started to collect data to see if posterior width changes had any impact on tongue position and airway.

In all of these areas, I have seen enough positive data to support the use of lower-force/lower-friction mechanics. Unfortunately, due to my own personal family health issues and simple lack of time, I have been unable to complete and publish all of this data. In today’s world, the demand on everyone’s time makes it nearly impossible for a busy practicing clinician to do a well-documented and well-controlled long-term retention study. Since the days of Edward Angle, think of how few long-term retention studies have been done evaluating conventional treatment planning and mechanics. My hope is that one day a retention study of a scope similar to Dr. Little’s study at the University of Washington can be done on the Damon System in a well-controlled academic environment.

Fig. 7 A. 15-year-old female patient with severe upper and lower crowding treated without extractions using early Damon brackets. B. Patient after 20 months of treatment, including considerable very light-force torque bending in finishing archwires. Mandibular arch width increased by .5mm (canines), 9.5mm (first premolars), 5.5mm (second premolars), and 4mm (molars). C. Five years after debonding, note maintenance of mandibular expansion, with no posterior retention after first year (red vertical lines = increase in arch width during retention period; blue vertical lines = decrease in arch width during retention period). Note excellent quality of labial/buccal and lingual alveolar bone in medical CT scan.
DR. KEIM Are there differences in the Damon approach to treating adolescent vs. adult patients?

DR. DAMON Living in a smaller community where many patients tend to stay in the area has given me the opportunity to follow a significant number of them for many years in retention. Carefully evaluating these patient outcomes has had a profound impact on my clinical mechanics and treatment planning. For the past eight years, we have used an in-office cone-beam computed tomography (CBCT) scanner to help evaluate some of these patients in retention, and I can say with conviction that passive self-ligation and the Damon System definitely have expanded treatment options for adults, with positive long-term radiographic results. What we have learned from these scans is that researchers should be very careful with post-treatment timing when the desire is to evaluate the presence or absence of alveolar bone. It is strongly advised to wait several years after treatment to allow bone densities to be high enough to be picked up and to show on these scans. At this time, medical CT scans are still far more diagnostically thorough in evaluating the presence or absence of alveolar bone. Unfortunately, the cost and radiation exposure of medical CT scanning is a deterrent. However, utilizing lower-radiation CBCT technology, I have seen enough long-term retention evidence to conclude that the gap has narrowed in treatment opportunities between adolescent and adult patients.

Another interesting side issue is that periodontists in my practice area who were once reluctant to send patients for orthodontic care now see a significant benefit for many of their periodontally involved patients in seeking Damon System treatment.

DR. KEIM What’s in the future?

DR. DAMON Looking into the future, I think the progressive office will be smaller in size yet incredibly efficient, utilizing the best technology and producing very high-quality treatment results. I think patients will continue to desire superb results in a shorter period of time with far fewer appointments. I also think that one of the greatest opportunities for clinical orthodontics is to become a significant player in the treatment and management of airway issues for patients. In the future, I think treatment planning will be greatly influenced by the long-term impact of the treatment results not only on the face, but on final tongue position and airway as well. I think the biocompatible aspects of passive self-ligation, including its effects on posterior arch width, will have a significant impact on positive airway control for many patients. Obviously, more research is needed in this very promising area.

DR. KEIM Dr. Damon, thank you for sharing your philosophy and techniques with our readers.

REFERENCES