

'The phenomenon of Low Friction Techniques: State of the Art'.

The Damon[®] System — Simplified Mechanics

Written by Dr. Alan Bagden, D.M.D.



Dr. Alan Bagden

Dr. Bagden graduated from Lafayette College in 1975 and was accepted at the prestigious dental school of the University of Pennsylvania. After fulfilling a military obligation with the United States Public Health Service, he was accepted as an orthodontic resident at the University of Maryland. In 1987, he joined the practice of Dr. William Wallert. The two worked together for 10 years, when Dr. Wallert chose to decrease the amount of time spent with full-time patient care. During his career Dr. Bagden has been recognized for his commitment to efficient treatment and has authored many research articles on this topic. In 2000 Dr. Bagden performed clinical trials and research on the Damon System of orthodontic treatment and concluded that it was the most efficient type of orthodontic treatment available. He then began working closely with Dr. Damon to further refine the technique and has been instrumental in advancing use of the Damon system within the orthodontic profession. Dr. Damon and Dr. Bagden conduct seminars worldwide instructing doctors on the proper utilization of the Damon system. It is Dr. Bagden's firm belief that the Damon system of orthodontic treatment will become the industry standard system of treatment by the year 2010. In addition to his clinical involvement with this project Dr. Bagden is also Board Certified by the American Board of Orthodontics, an honor enjoyed by less than one quarter of all orthodontists in the United States. He has served as President of the Virginia Association of Orthodontists and the Northern Virginia Dental Society. He has been inducted in the Pierre Fauchard Honorary Dental Society and the American College of Dentists in recognition of his contribution to the profession. Dr. Bagden is a frequent lecturer at the University of Maryland Orthodontic Residency program and the National Children's Hospital Center Orthodontic residency program.

DAMON[®]SYSTEM
More than straight teeth[™]

The Damon[®] System – Simplified Mechanics

The Damon System of passive self-ligation is an orthodontic technique which utilizes the advantages of a bracket that allows for less binding, and as a result, more effective sliding mechanics. The System is made up of three parts. The first and basic premise, of the System is as follows: When the elastomeric modules of traditional orthodontics are applied, a restrictive component of the wire attempting to slide along the bracket is introduced. When these elastomers are removed, teeth can slide along the wire with greater ease and efficiency. Secondly, the Damon System has successfully combined the concept of a passive self-ligating bracket with modern high technology arch wires. The most common of these wires are alloys of Copper and Nickel Titanium (CuNiTi) and Titanium Molybdenum Alloy (TMA). The special properties of these wires also assist in delivering consistent, light forces throughout the duration of treatment. For instance, TMA is a bendable, permanently deformable wire which exhibits up to 1/3 less force than stainless steel when compared to same wire dimensions, i.e. a .019 X .025 TMA wire will deliver approximately one third less force than a .019 X .025 stainless steel wire. CuNiTi, in normal use, will not permanently deform, which gives it the advantage of delivering consistent light forces which can range from less than 100 to more than 300 grams of force. When CuNiTi is used as an initial wire, the forces delivered can be below what the restrictive force of the opposing orofacial musculature can be. As a result, the expected flaring of crowded incisors seen in traditional orthodontic delivery systems is not observed. To the contrary, lateral development, rather than incisor proclination, is observed. The third component of the Damon System is a simplified, logical, treatment protocol. Low friction/ light force orthodontics means more than just a passively ligated bracket, it's a whole philosophy that embraces mechanics, forces, biology and the high-tech materials to aid in accomplishing excellent results.

I have always felt that to achieve consistently high standards, the fundamentals of a low friction system have to be fully understood. Certain aspects of treatment are essential to success. For this reason I composed "The Twelve Pearls of Damon Treatment" in 2003 which were those treatment particulars that I believed practitioners should follow at the time; those essential treatment specifics which would lead any practitioner to success with the Damon System. They were:

- 1). Vary torques in initial prescription to achieve optimal results
- 2). Always bond second molar to second molar to facilitate bite opening and rotational control. Take a panorex after the rectangular Damon Copper NiTi phase (the second phase of treatment) and reposition any improper bracket placements.
- 3). Always start with an initial .014 Damon Copper NiTi archwire which is left in place for a ten week period.
- 4). Place stops (crimpable or flowable composite) on the arch wire anterior to the crowding ...this is usually between the central incisors.
- 5). Develop the lateral dimension through archwires and balancing the orthodontic forces with facial musculature rather than inserting high forced rapid palatal expansion appliances.
- 6). Deep vertical bites can be opened using different options based on lower arch requirements.
- 7). Place chains for space consolidation under the arch wire to minimize binding and friction.
- 8). Move teeth in groups rather than individually. Maintain constant blood supply to all teeth; leave no tooth alone and not incorporated into the arch wire. Use no single tooth retraction. Don't coil a tooth and not ligature tie it to the archwire.
- 9). Close spaces on pre-posted steel arch wires in the final phase of treatment. Finish cases (arch form and detailing) in rectangular TMA or steel arch wires. Steel wires are .016 X .025 or .019 X .025. TMA wires are .017 X .025 or .019 X .025.
- 10). Class II and Class III elastics extend from the posts on the final arch wires to the first molars. Use two 5/16 in., 6 oz. elastics at night in difficult adult cases.
- 11). Modify the final arch wire for each individual patient based on the arch form developed by the balance of forces. This form is established at the end of the high technology arch wire phase (second phase) and is typically based on the lower arch form.
- 12). BE PATIENT! Things can go slow and then happen all of a sudden.

Obviously time has elapsed since this initial composition, but the understanding that the Damon System is unique among most orthodontic techniques in that specific aspects MUST be followed in order to consistently deliver outstanding results has not changed at all. In fact, following the protocol remains an essential key for success. One can not simply acquire Damon System brackets, apply them in a random fashion, use any traditional mechanics an operator desires and then expect to achieve superior results. It just does not happen this way. With this thought in mind this chapter will present what is now believed, as I enter my second decade in Damon therapy, as those elements which are essential for success. While these components as designed to guide and assist the practitioner on a path to success, they not alone in providing the matrix for excellence. Many of them are the same "pearls" from the original list, others are new and more detailed, while still other components of treatment are more arbitrary, but when delivered with an understanding of what constitutes sensible Damon mechanics, are just as valuable.

Personally speaking, I came from a .018 system before I switched to The Damon System because conventional wisdom at the time (the 1980's) was that .018 systems delivered lighter forces than .022 systems. My thought at that time was that forces delivered through a small slot would be lower than those delivered through a larger one due to the fact that smaller wires were used with the .018 system. In a past era of stainless steel based wire technology, this was perhaps the situation. However, with the advent of NiTi, and especially CuNiTi, this perspective has dramatically changed. Stainless steel wires thrived on larger interbracket distance and small dimension wires. NiTi wires, due to their extreme flexibility, perform quite well with smaller inter bracket distance and, as mentioned above, due to their low forces delivery actually perform better in .022 systems. The Damon System synthesizes all of the above, as the largest wire utilized is .019 X .025. A .019 X .025 wire in a .022 X .028 bracket allows more freedom of movement within the bracket lumen (i.e. more "play" in the bracket)

and when combined with early light CuNiTi wires has the distinct advantage of delivering extremely light initial forces.

Early in my trials of the Damon System I desired to test whether teeth would in fact slide easier with a Damon PSL bracket than a traditional elastomeric-based bracket. I decided to perform a tightly controlled, split mouth study on randomly selected, yet similar bicuspid extraction cases, using The Damon System on one side of the arch and conventional .018 brackets on the other. The results were indisputably in favour of the Damon System, by the fact that the Damon side moved teeth up to twice as fast as the conventional side.

This is due to two main factors; 1 - reduced friction by the removal of an elastic or stainless steel tied ligature, 2 – the increased wire-to-lumen ratio that reduces the binding and friction between the bracket and the wire. These factors enable more efficient levelling and aligning during the early stages of treatment and more efficient sliding mechanics during the later stages. It must also be noted that even torquing and rotational tooth movements occur more rapidly when the low friction, passive Damon System is utilized.

The low forces delivered by following the Damon System protocol allow the Damon archwires, together with the passively ligated brackets, to work more in harmony with the patient's individual biological environment. This has the effect of providing posterior transverse arch development without the use of expanders. Space is created via each patient's individual response to the System. The arch form is not predetermined by an orthodontist or archwire form. As mentioned above, space develops as a result of the lateral development, rather than flaring. The results deliver a full, broad smile, with reduced proclination of the anterior teeth and stable posterior width changes. As a result, I have also seen a dramatic reduction in the need for extractions contributing to a positive effect on the patient's midface. The traditional ravages of extractions observed as patients continue to age have been minimized. The smiles are broader, lip support is greater, the mid-faces are fuller and aesthetics are exponentially improved as a younger, more youthful appearance is maintained throughout mid-life years.

Not every Damon case is to be treated as a non-extraction case, however. There are a number of instances where extractions are indicated and are the preferred treatment of choice. Examples are instances of bimaxillary protrusion, weak lip support, tongue thrusts, anterior open bites, high mandibular plane angles and excessively proclined teeth in fragile periodontal situations. When, however, extractions will help the profiles or overall dental health of these patients I extract the appropriate teeth to render the most favourable result.. Facial aesthetics, sensible orthodontic diagnoses and fundamental dental health are the essential determining factors.

TWELVE ESSENTIALS FOR MOMENTUM WITH DAMON TREATMENT

Over my past ten year journey through the Damon System it has become apparent to me that there are certain non-negotiable aspects of delivering prudent, high quality, sensible orthodontic treatment with the Damon System. These will be outlined below, in chronological order of implementation. If a practitioner is willing to philosophically adopt these components of treatment, it is my firm belief that success from a professional and patient perspective, as well as long term stability will be achieved. In a sense, these are the truisms of the Damon System. Adoption will lead to success....violation will lead to failure.

1. DIAGNOSIS AND TREATMENT PLANNING... Understanding that diagnosis and treatment planning is the most essential aspect

of orthodontic case management, the Damon System suggests that each practitioner invest considerable time and energy into adequately diagnosing each patient's case prior to initiating treatment. Without an organized, detailed treatment plan there is no direction to a case. However, rather than relying on merely traditional cephalometrics to diagnose a case, the practitioner must incorporate a more holistic view of a patient before initiating treatment. Facial aesthetics (fullness vs. flat profile), lip competency, tongue posture and position, occlusal interferences and tooth size must be evaluated along with the more traditional aspects of incisor position, interincisal angle and mandibular plane angle. To merely diagnose a case based on NORMS and STANDARDS is not what constitutes a Damon diagnosis. Cephalometrics and Bolton numbers, while a valuable part of developing a treatment plan, are not the sole determining factor in treatment planning cases. For instance, as we will see later, due to the unique construction of anchorage in Damon System cases, Class II correction is viewed from a different perspective than a traditional case. Likewise, deep bite, brachycephalic cases look at the utilization of disarticulation (i.e. bite turbos) in a different manner. Rather than diagnosing from an extraction vs. non-extraction viewpoint, a Damon practitioner needs to determine how anchorage will be deployed, how the heavy forces of occlusion are to be overcome, how the factor of lip competence will be viewed and even how blocked out teeth are to be managed (i.e. bypassing vs. tying in) become factors in diagnosing and treatment planning. It is not simply a matter of looking at crowding and cephalometrics. Far more must be considered in developing a sensible case construction.

2. TRADITIONAL VS. ACTIVE VS. PASSIVE LIGATION... Intense debate rages concerning which method of orthodontic ligation is the most efficient and beneficial mode of delivering orthodontic treatment. Panel discussions, journal articles, journal editorials, professional meetings and informal get-togethers are all arenas in which this hot topic is contested. Not since the days of the legendary Case/ Angle debates has an orthodontic philosophy incited such intense passion. In spite of all discussion, passive self-ligation remains the most rapidly adopted technique in the history of the orthodontic profession. (Perhaps this is why the debate is so intense). To those who have adopted the Damon System there appears to be little reason to dispute Dwight Damon and his philosophy. A passive self-ligating bracket (PSL) has the least interface between a bracket and arch wire of any orthodontic delivery system. If the goal of treatment is to allow teeth to slide along the archwire (hence the wire is least encumbered by the binding instigated by the bracket) there can be no question that PSL is the optimal technique to use. And if the PSL allows the teeth to slide along the bracket the easiest, it stands to reason that a PSL needs the least amount of force to initiate such movement. If a PSL needs the least force to move teeth, then the lighter the forces delivered, the more biologically sensible the System is. If the muscles can control the light forces associated with tooth movement with PSL, anterior tooth position can be and is maintained by the balancing of the muscular forces of the lips and tongue. The result is lateral arch development and anterior tooth position stability. Active ligation and conventional brackets, by virtue of the fact that more binding is introduced, restrict the ability of teeth to slide along the wire when compared to PSL. Current studies underway under the guidance of Dr. Hisham Bidawi substantiate this claim.

Using an OSIM orthodontic simulator, he has shown the binding levels to be lower with PSL and the resulting tooth movement to be less restricted.

3. TORQUE... An argument postured by active and conventional ligating theorists revolves around torque. The argument being that a PSL bracket cannot deliver torque due to the fact that one needs to "seat" the wire in the bracket in order to establish torque. However, torque comes from the incisal and gingival walls of a bracket, not the base. PSL brackets are NOT frictionless, i.e. there is and must be interface between the wire and the bracket in order to direct tooth movement. While PSL has interaction between a wire and bracket, the amount of binding and friction between wire and bracket is less than with conventional and active bracket systems. Therefore, in order to facilitate movement along the arch wire and to develop more "play" in the system, the largest wire in the Damon System is a .019 X .025 Stainless steel wire.

The Damon System is founded on the principle of "Variable Torques". Multiple torques are available for many teeth. Maxillary incisors have three specific torques, i.e. (High, Standard and Low). Mandibular incisors and all canines have two torques (Standard and one variation). Premolars have only one torque per tooth.

High torque maxillary brackets are generally used in Class II cases, extraction cases and those instances where additional angulation is desired. Low torque brackets are used in maxillary and mandibular incisors where there is a desire to combat flaring from either a situation of severe crowding or mechanics which would tend to cause flaring (i.e. Class II elastics on lower incisors).

Future generations of Damon brackets will likely incorporate even more variations for torque. As more and more cases are treated it is apparent that other options will be of distinct advantage

4. INITIAL APPOINTMENT... Understanding how to commence Damon treatment can not be emphasized enough. Great care and understanding must be employed when starting a case with the Damon System. The following components are essential.

- a). All teeth must be incorporated in the system, that is, the construction must extend from second molar to second molar in the maxilla and mandible. Forces need to be distributed throughout the entire mouth, not focussed on certain teeth. Bonding procedure, i.e. direct vs. indirect, are personal decisions made by each doctor as is bracket position, bracket placement and method of construction.
- b). All cases must start with an arch wire NO LARGER than .014 CuNiTi. The wire should be left in place for no less than 10 weeks before proceeding to a larger diameter. Typical wire sizes are .013 (10-15% of cases started) and .014 (85-90% of cases started) CuNiTi.
- c). Binding and friction are extremely low with PSL brackets. So, if care is not taken to secure the wires and prevent their lateral movement, numerous emergency appointments will be needed to address asymmetrical wire movement. Crimpable stops need to be placed on all CuNiTi wires to prevent the wires from sliding from side to side. In the maxillary arch a stop is placed 1 mm from the mesial and distal sides of the bracket of the tooth which is most anterior from the crowding and needs the least movement. In the lower arch a single stop is placed as close to the midline as possible, anterior to the crowding, between the two teeth which are in the best position.

- d). In situations where teeth are blocked out there are two options. If anterior movement of the anterior teeth is desired, all teeth are incorporated into the System which allows for anterior movement (proclination) of the incisors. To the contrary, if anterior position stability is desired and more lateral movement than anterior movement is desired, a coil spring 1- 1 1/2 times the size of a bracket is placed and if the tooth is lingually/palatally blocked, the blocked tooth is tied to the coiled arch wire with .010 stainless steel ligature. Doing so assists the anterior teeth in not flaring forward and encourages greater lateral development.
- e). If interference between brackets and opposing teeth are created during initial construction, bite turbos (Pearl # 6) are employed.
- f). If "colored ties" are requested by the patient, they are placed under the wire and over the bracket. They serve no purpose other than decoration.
- g). Severely rotated teeth can be "de-rotated" by placing elastic chain under the wire and tied in the appropriate direction. If difficulty is encountered in closing the slide on the brackets due to rotation, it is advisable to close the slide before placing the arch wire, i.e. convert the bracket into a tube.
- h).***A word of caution...light forces are best. When in doubt, use the lighter wire available and place niti coils where teeth are blocked. Larger wires, engaged in all teeth, can provide undesirable flaring of anterior teeth.

5. WIRE PROGRESSION... To adequately begin a discussion on wire progression one must first realize the treatment stages of the Damon System as they relate to the phases of treatment. The four phases of Damon treatment are 1) round CuNiTi, 2) rectangular CuNiTi, 3) Major mechanics (posted wire phase) and 4) Finishing. Treatment stages are 1) Dento-alveolar development, that is, the initial arch form development, rotation and alignment 2) Torque Control and Levelling, that is, the implementation of rectangular wires to continue arch form development, root inclination, continued bite opening and space control, and 3) Completion of the first two treatment stages coupled with finishing and detailing. Both the treatment stages and the treatment phases correlate with actual treatment milestones, i.e. certain procedures which are performed at prescribed junctures of treatment. These are the initial bonding appointment, the repositioning appointment (when a panorex is taken and bonds are repositioned in response to the positions noted on the panorex), arch coordination appointment (wax bite) and the band removal (debond) appointment.

To summarize the phases of treatment and the treatment that takes place in each phase, the following is outlined:

Phase I – Levelling and aligning

Arch development is initiated by the use of .014 Damon Copper NiTi or .013 Damon Copper NiTi if severe rotations or periodontal issues are present. The aim of this phase is to resolve 90% of the rotations, which should be accomplished in 10-20 weeks. As I routinely have 10 weeks between appointments during this stage, this equates to 1 or 2 visits. It is essential that archwire stops are used to prevent wire sliding distally from the buccal tubes. Always place these stops anterior to crowding.

Phase II – High tech edgewise

Leveling and aligning is completed and all remaining rotations are re-

solved. Torque control is initiated together with anterior space consolidation. Arch development is still progressing.

The wires generally utilized are .014 X .025 then .018 X .025 Damon Copper NiTi. In a deep bite division 2 case, a .017 X .025 or .019 X .025 Damon reverse curve NiTi is also a good option.

A panorex is very often taken so I can see if any brackets need to be repositioned. The duration of this phase is usually from 10-20 weeks, but now I have 8 weeks in between appointments.

Only move onto the next phase when a stainless steel wire can be inserted passively.

Phase III – Major mechanics and finishing

Torque control is completed and all posterior space is consolidated by using tie-backs which also prevent posterior space from re-opening.

This is the time to fully coordinate the upper and lower archforms by copying the lower archform already present and making the upper archwire 1-2mm larger all around the arch. If slightly more arch width is required, for example in some cross-bite cases, then the archwire may be expanded slightly at this point. Our testing has shown that by using this technique, the forces are still kept to a very low level. The duration of this phase is anything from 20-40 weeks with 6 week appointment intervals for the major mechanics and 4 week intervals for the finishing. This enables maximum time management in your practice and maximum treatment of patients in the shortest duration possible.

Phase IV – Finishing

Finishing is a personal decision for each practitioner. I generally use TMA wires to finish my cases, along with specific elastic patterns to aid and assist final positioning of the teeth. Great concentration is given to gingival margins as they should be equal in height signifying proper tooth-to-tooth relationships as well as ideal buccal-lingual root positioning.

Utilization and incorporation of .018 X .025 CuNiTi in wire sequencing is worth noting. It appears that this wire is a threshold wire. Wires smaller than this in size and dimension appear to allow the "patient specific biological response" to occur. Once .018 X .025 is inserted it begins to "drive" the archform in that once left in place for more than six weeks, the individuality of the arch is no longer driven by the biological response of the patient. All arches begin to have the same form in that the .018 X .025 CuNiTi has overpowered the biology and replaced it with the generic Damon arch form. **BE SURE TO NOT LEAVE .018 X .025 CuNiTi WIRES IN FOR LONGER THAN SIX WEEKS.**

6. **THE THEORY OF DISARTICULATION...** The forces of occlusion will overpower what the light forces of the CuNiTi wires in the Damon System can deliver. Progress will be minimal if occlusal forces limit the ability of the wires to express themselves. As a result, it is imperative that disarticulation be instituted in the Damon System in order to maximize the biological response to the light Damon forces. Anterior bite turbos appear to be the best method for disarticulation. By placing them on the lingual surfaces of the maxillary incisors they allow for posterior disarticulation. The posterior disarticulation allows for unencumbered lateral development, light force space closure, more efficient alignment, more efficient levelling and faster treatment times without needing to apply heavy forces. In cases of anterior open bites and extreme overjet which preclude contact of an anterior bite turbos, posterior bite turbos, placed on the buccal cusps of the mandibular second molars will suffice. Be aware that bite opening will not

occur with posterior bite turbos, so they should only be utilized in instances where bite opening is not desired. Transverse lateral development (i.e. crossbite) correction is also facilitated by disarticulation. By removing the occlusal forces on posterior teeth, greater freedom for lateral expression is achieved and ensuing transverse correction can be more readily attained.

7. **EARLY TREATMENT...** The light force delivery of the Damon System lends itself well to those cases where early intervention and treatment is indicated. The goal of early treatment has historically been to correct a developing malocclusion and create an environment where favourable growth and development will occur which, in turn, minimizes the amount of treatment which will need to be performed at a later time. Severe crowding and severe skeletal abnormalities have been the primary facets addressed. This remains among the focus of early treatment with the Damon System. However, understanding light force orthodontics has enlightened many practitioners to include in early treatment diagnoses those cases where creating space prior to eruption of permanent teeth (particularly canines) allows the permanent teeth to erupt into keratinized tissue, resulting in more favourable periodontal health. The Damon Space Gaining Appliance (D-Gainer) is the mechanotherapy utilized to create space for erupting teeth with the intent that teeth will not need to be extracted AND they will erupt into keratinized tissue for improved periodontal health. A variation of the traditional "2 X 4" appliance, its distinct advantage over previous designs is the fact that the use of PSL brackets allows the anterior teeth to remain in a more upright position and the space necessary for eruption of the permanent teeth comes primarily from the lateral development typically seen with the Damon System. Low torque brackets are used in its construction (to minimize flaring) and medium Niti coil springs are used between the lateral incisors and first molars. The coil spring is activated 1 – 1 ½ brackets larger than the necessary space. Patients are evaluated every 8 weeks and the NiTi coil spring is re-activated at these appointments until the desired result is achieved. The vast majority of these cases do not require extraction of permanent teeth and enjoy an excellent periodontal status.

In cases of developing Class II skeletal relationships a "Telescoping" Herbst appliance is constructed with stainless steel crowns on all four permanent first molars to support the appliance. Typical age for initiation of Herbst therapy is 10.5 years for females and 11.5 years for male patients. The Herbst is typically worn for 15-18 months at which time it is removed and the patient segues into full fixed treatment. Buccal tubes can be soldered onto the molar crowns allowing the practitioner to simultaneously construct a D-Gainer along with the Herbst. By doing so the options for treatment are increased from simple Class I crowded cases (D-Gainer alone) through to severe Class II, Division 2, cases with severe crowding (D-Gainer with Herbst). As with a D-Gainer, the Herbst is advanced every 8-12 weeks until an edge-to-edge relationship is achieved, at which time the edge-to-edge relationship is maintained for a 3-6 month period followed by the Herbst's removal.

8. **SPACE MECHANICS...** Interesting to note is that the same metallic mechanotherapy, NiTi coils, are used for both space opening and space closure. Medium NiTi coils are used for their ability to deliver a consistent force throughout the duration of need, when lack of (crowded non-extraction cases) or excessive (spacing or extraction cases) space is treated.

- a. Crowded cases...as already mentioned, when teeth are blocked out, medium open coil springs are placed in the area where space is desired. The amount of coil used is equal to the space present PLUS 1 – 1 ½ a brackets width. The arch wire can be as thin as a .014 round CuNiTi wire if the NiTi coil is light. Little deformation or distortion of the wire is demonstrated providing the coil is kept light. If more coil is used, space does not open any faster and the clinician runs the risk of flaring the anterior teeth due to excessive lip or cheek pressure exerted on the coil and the tendency for the initial light CuNiTi wire to be adversely influenced by the coil and muscular pressure. When a tooth is blocked lingually or palatally, the blocked tooth has a button, eyelet or mini-tube bonded to it and then the attachment is tied to the coil on the arch wire with a .010 steel ligature wire. Successive visits will require reactivation or re-insertion of new coil keeping it at the 1 – 1 ½ brackets specification. The blocked tooth may not have enough space available in order to successfully bond a Damon bracket. Likewise, in those instances a ½ Siamese bracket, an eyelet, a hook or button is bonded to the tooth and the steel ligature is tied accordingly. Once sufficient space is gained, the attachment is removed and a normal Damon bracket is placed on the tooth.
- b. Spaced cases... Traditional elastic chain, placed under the arch wire, from canine to canine, is used to consolidate spaces on an arch wire no smaller than a .016 X .025 CuNiTi wire. Space is gathered distal to the canine and mesial to the first bicuspid in either extraction or spaced cases. Once the space is localized in that area, a .010 steel ligature wire is used to ligate canine to canine together in order to keep the anterior spaces closed. This anterior ligation will remain in place, under the arch wire, for the remainder of treatment as the case proceeds to a posted wire, typically .019 X .025 posted steel in the upper and .016 X .025 posted steel in the lower. A posted wire is that wire where a crimped or soldered post is added to the steel wire in the interproximal area between the lateral incisor and the canine. Typically, a 9 mm Medium NiTi coil spring with an aperture on each end is added to the arch wire, extending from the crimped or soldered post to either the arch wire as it extends out of the tube (in minimum anchorage situations where the arch wire is cut distal to the first molar) or on the buccal hook of the first molar (in maximum anchorage situations where the arch wire extends through the second molar and the first and second molar are ligated together for increased anchorage). The NiTi coil should close the space at a rate of 2 mm/ 6 week interval. If space does not close at that rate, a stainless steel Pletcher coil is added to the system in the same configuration as the Niti coils are used. A Pletcher coil, being of steel with stronger forces, will generally close the space faster. It is only activated 3-4 mm, however, and this minimal adjustment requires more frequent appointment intervals for the purpose of continual activation.

Once space is closed the arch is secured via molar to molar ligature with .010 steel ligature ties or with elastomeric “tie-back” modules. The tie-backs are placed from the post on the wire to the buccal hook on the first molars. The purpose of the tie-backs is to keep the spaces closed. Keep in mind that a steel ligature wire, placed from canine to canine, under the arch wire, following consolidation, is kept in place until the case is completed. At this point in treatment all spaces

should be closed, the patient should have steel posted wires in place and the case is ready to be finished.

9. ELASTICS...The purpose of elastics in the Damon System is to guide the teeth into the desired positions, without the cumbersome aspect of binding generally associated with traditional orthodontic therapy. The main elastic utilized is a 5/16...6 ounce...elastic. These are generally used in the third phase (major mechanics) for Class II and Class III corrections. NOTE: The arch wire is cut distal to the lower first molar for Class II correction and distal to the upper third molar in Class III correction in order to allow the sliding mechanics as outlined in the anchorage section to occur. Cross bite elastics generally are 3/16...4 ounce...elastics. Vertical closing (finishing) elastics are generally the 5/16...6 ounce...variety. Recently, great attention has been given to “early” elastics. That is, starting elastic wear in the initial wires in situations where a major Class II or III correction, open bite or transverse correction is desired. Generally, for Class II correction a 2 ounce elastic, from the upper first premolar to the lower molar is used in the light round arch wires. As the case progresses to rectangular wires a 4 ounce elastic is employed from the upper canine to the lower first molar and, finally, in the posted steel wire phase a 6 ounce elastic is used as outlined above from the post on the maxillary arch wire to the lower first molar. Impressive corrections of severe malocclusions have been and are being achieved via the use of early elastics. As 2009 progresses it is my belief that more uses of early elastics will be displayed and employed.
- 10 ANCHORAGE...Effective and efficient anchorage is the goal of successful orthodontic treatment. In order to develop and maintain the proper occlusion anchorage is essential in maintaining tooth positions in some situations (maximum anchorage) and allowing them to move (minimum anchorage) in others. PSL clearly shows benefits when anchorage demands are indicated. Traditional orthodontics has resorted to many modalities in efforts to establish anchorage. Extra-oral devices, such as headgears, have been commonly used for years. Intra-oral appliances, such as transpalatal arches, lingual arches, Nance holding arches and similar designs have been used, but are contraindicated in the Damon System as their “transpalatal” aspects limits the desired lateral development so essential to successful Damon therapy. Quite simply, an arch can not develop laterally when a transpalatal arch is maintaining that dimension, much as a fixed lingual arch maintains the width in the mandibular arch. Recent advances in anchorage have been shown in terms of the presentation of Temporary Anchorage Devices (TAD’s). These can be used successfully with the Damon System due to their non restrictive aspect of lateral dimension. Placing a TAD in a recipient site allows for anchorage without limiting the lateral development of the cases. They have been shown to be very effective in tooth translation, but are particularly indicated in vertical correction, most notably intrusion of teeth. They are, and should be, part of a contemporary orthodontist’s armamentarium. The Damon System capitalizes on the lack of binding when establishing anchorage. The second molars become the key to its establishment. As previously discussed incorporating second molars into the appliance allows not only for adequate dissipation of forces throughout the dental arches, it also allows for increased anchorage when needed. With so little binding evidenced in PSL the teeth slide along the arch wire more freely than previ-

ously seen, and, as a result, the “strain” of anchorage is lessened. Hence, merely by incorporating second molars in the appliance will allow for increased (maximum) anchorage. Conversely, eliminating second molars from the appliance (cutting the arch wire distal to the first molar) reduces the anchorage of the System and allows the posterior teeth to slide forward far easier (minimum).

Class II correction can be achieved by incorporating the second molars in the upper appliance, and by cutting the arch wire distal to the lower first molar. Upper anteriors are retracted and lower posteriors are protracted. Situations for Class III correction, profile needs and congenitally missing teeth space closure can all be addressed by manipulating the anchorage of the case.

So, anchorage has always been a great concern with conventional appliances, but when the Damon System and its protocol are followed, this is not as great of an issue to consider. The anchorage demands of the Damon System are far lower than conventional systems due to the considerably reduced friction offered by the passive lumen all Damon brackets possess. I have virtually abandoned the use of transpalatal arches and Nance holding arches within my practice.

11. FINISHING... BOTH ORTHODONTICALLY AND COSMETICALLY...

As mentioned above, finishing is a personal decision for each operator. What one doctor believes constitutes a finished case may differ dramatically from another. For simplicity I suggest that a panorex be taken at the end of the rectangular CuNiTi wire phase in order to evaluate root parallelism and reposition those brackets which are not adequately positioned. In my opinion, however, more attention should be given to buccal-lingual root position. It appears that a great number of relapsed cases relapse because the apex of lingually/palatally blocked teeth are not brought forward significantly. If the apex is left lingual, once retention is ceased, the tooth will begin to upright to the original position of the apex. If the apex has been left in an adversely lingual location, the tooth will upright lingually and relapse crowding will ensue. Without the advantage of a cone beam/CAT scan a basic clinical observation of the gingival margins should give the operator an indication as to whether the root has been brought buccally enough. If excess tissue is apparent on a particular tooth the chances for relapse is great. I encourage all practitioners to be adept at adding positive root torque (i.e. negative crown torque), particularly on anterior teeth, to be able to upright the teeth and align gingival margins. TMA is a wonderful wire to use as a finishing wire as it allows gentle torque to be placed in the wire for root torque and also small in-out/ incisal-gingival steps can be placed.

Tooth recontouring is also of great benefit in aesthetic finishing. Adult cases can particularly benefit from re-contouring in an attempt to establish a more “polished” finished case by removing asymmetric wear patterns on teeth and level out incisal edges. Gingival recontouring with the aid of a laser is also of benefit in delivering an aesthetically finished case. A finished case ideally has even gingival margins and well contoured and shaped teeth.

12. RETENTION AND STABILITY...

A case is only as successful as its stability. I strive to deliver the “WOW” case. To me a case should not only be **effective** (i.e. good occlusion)... it must be **affective** (deliver a response to the owner of the smile and everyone who sees it. It affects the way someone is perceived or thinks about themselves. They are **affected** by the smile!) as well. The Damon System has been in existence for more than ten years. Over 2 mil-

lion cases have been treated and the vast majority of situations have delivered extremely positive results. The key is to maintain the good results and to maintain the stability as the years following active treatment progress. We want our cases to be as “**effective**” in 20 years as they are now. We want our patients to be as happy (**affected**) with their results in 20 years as they are now. We as professionals want the pride a well-treated, stable case gives us.

Retention protocol is quite routine. A fixed bonded retainer is placed lingually on the upper four incisors and on the lower six (canine to canine) teeth. Bond-A-Braid (.016 X .022) is used as the retention wire. In addition to the fixed retainers a removable night time retainer is given as well. In most cases, a simple vacuum-formed “Essix”-type retainer is used. In more severe malocclusions, (i.e. severe Class II or Class III, open bite and crossbite cases) a Damon Splint is utilized. This consists of two invisible retainers affixed together with hard acrylic so that it is worn as an athletic mouthguard might be worn, at night. In Class II cases the construction bite is made with the teeth in an edge-to-edge relationship to encourage forward posturing of the mandible, much the same as a functional appliance would. For Class III, open bite and transverse situations, the wax bite is constructed in the centric relation position. Damon splints are fabricated with the intention that they will be worn at night, indefinitely.

It has been most gratifying to follow my cases throughout the past eight years. The stability, periodontal health and, most importantly, the aesthetic results have been more than gratifying. We have successfully **affected** a smile which continually has the **effect** we desire, that is, a content, confident, attractive and healthy individual.