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Introducing the Damon System II

New Generation Bracket for Improved Function

After working on self-ligation for 9½ years and having used it consistently in my practice for 3½ years, I am more excited than ever about the direction that self-ligation will take our specialty. I have concentrated on five major areas: improving treatment quality and control, dramatically increasing patient comfort, decreasing treatment time and decreasing chairtime with longer appointment intervals. I feel we accomplished these goals with my original bracket design. As gratifying as the results have been, I fully recognized that the bracket itself had mechanical challenges. If doctors around the country were to take advantage of its benefits, they had to be offered a bulletproof bracket system. The new Damon System II is such a bracket. It offers all the advantages of the original Damon as well as design improvements that overcome its challenges. What we learned about rotational and torque control in the original system and about the needs of doctors and staff members worldwide, we incorporated into the new design; meanwhile, we maintained the design criteria that made the results from the original Damon SL remarkable. The photographs and illustrations on the opposite page outline the new design improvements.

Control: The Key to Treatment Quality and Efficiency

More comfortable and faster tooth movement is exciting, yet control of tooth position is still the standard by which quality treatment is measured. Cases I and II (pages 4 - 5) illustrate the capability of this mechanical system with minimal bending of archwires.

Passive Self-Ligation: More Than Quick Archwire Changes

It’s my belief, gained from pouring over hundreds of cases with records taken at frequent intervals, that by minimizing the interruption of blood flow in tooth movement with low-force wires, we have shortened treatment time, lessened patient discomfort and brought the treatment time of adults within the range of children’s. We are experiencing tremendous growth in our practice from patient-referred sources as a result of using these combined technologies: the Damon appliance and high-tech, low-force wires. Today’s lifestyles place demands on all our time. When you can decrease treatment time and extend appointment intervals, orthodontic treatment appeals to a much larger segment of the population.

continued on page 4
The Damon System II maintains the advantages of the original Damon SL design while providing ease of clinical use and dependability. It is a fully programmed Straight-Wire® Appliance with twin configuration.

- Reduced profile means increased patient comfort, fewer bond failures and ease in bonding brackets on malposed teeth.
- Improved finish - Attractive, highly polished surface. Optional "Rolex" look of gold tone on slide offers a distinctive upscale look and makes the bracket look smaller.

The brackets continue to open away from the clinician, making it easy to determine when the archwire is engaged in the slot. The closed slide forms a complete tube critical for rotational control.

OptimeshXRT coating increases bond strength 35% (proven by independent testing).

The streamlined design and simplicity of the mechanism improves production consistency and precision.

More anatomically correct pad contours fit the facial surfaces of the teeth better for easier bracket placement and fewer bond failures.

Easy to open and close, robust, dependable slide makes a distinct clicking sound when opened/closed.

Front View - A 35% decrease in bracket width means easier archwire engagement and improved mechanics through greater interbracket distance.

Occlusal View - The slide is now fully captured in a channel, decreasing exposure to occlusal forces and food capture, which reduces bond failures and improves hygiene.
The most obvious advantage of self-ligation is the timesavings realized during archwire changes. Certainly, this advantage is one that most staff members recognize and welcome. Well beyond this advantage is the opportunity that the bracket system affords in capitalizing on the still relatively new high-tech, low-force wires. Because the bracket system is passive, it is virtually friction-free. While there continues to be debate about the role that friction plays in tooth movement, I simply ask doctors to make judgments based on their clinical experience with the system. Although I do not fully understand what I see clinically, it seems to me that the existing research explaining tooth movement indicates that reduced friction allows lower force wires to operate at peak expression, thereby stimulating more biologically compatible tooth movement, promoting greater efficiency and comfort.

Tooth movement is a complex issue. From Tuncay's outstanding research we've learned that "oxygen is the trigger mechanism on the periodontium." In other words, oxygen must be present in order for teeth to move. Proffit indicates "Optimum force levels for orthodontic tooth movement should be just high
enough to stimulate cellular activity without completely occluding blood vessels in the PDL. "I call this area the Biozone." To remain in the Biozone, one must apply a force strong enough to stimulate cellular activity without cutting off the vascular, thus the oxygen supply. True biomechanics means staying in the Biozone. I feel that using conventional ties – O-rings and stainless steel ligatures – makes staying in the Biozone nearly impossible due to binding and friction. As Proffit states, "If the applied force is great enough to totally cut off blood supply, it... must revascularize before teeth start to move."2

Vourdouris measured friction produced by three types of brackets: conventional twin brackets with O-rings and stainless steel ligatures, active self-ligation brackets, and passive self-ligation brackets, which included the Damon SL (Figure 1).3 The Damon SL required the lowest force to pull the archwire through a single bracket. With an .019 x .025 wire, the two conventional brackets tied with O-rings produced significantly more friction than either type of self-ligating bracket (approximately 500 to 600 times greater than the Damon SL). Brackets tied with stainless steel wires showed 300

4 The day the appliance was placed: .022 Damon SL brackets with .014 Align SE nickel titanium archwires in both arches. (At the first return visit, .016 x .025 Align SE archwires were placed into both arches. At the second return visit, pre-posted .019 x .025 stainless steel archwires were placed.)

Fourth return visit after 8 months, 3 weeks of treatment.

The day the appliance was placed.

Finished case: total of 8 appointments. 16 months in treatment.

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Dr. Damon
continued from preceding page

Figure 1. Frictional resistance comparison.

<table>
<thead>
<tr>
<th>Friction resistance levels of passive and active self-ligating brackets (g; 1N=0.102g) and conventional twin archwires of .020 and .018 x .025 stainless steel archwires at .0º angulation (reprinted by permission).</th>
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<tbody>
<tr>
<td><strong>Conventional</strong></td>
</tr>
<tr>
<td>Twin (“A” Company Twin)</td>
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<tr>
<td>Twin (Ormco Diamond)</td>
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<td>Twin (Amer. Master Series)</td>
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<td>Active Interactive</td>
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<td>Twin (American Sigma)</td>
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<tr>
<td>Passive Interactive</td>
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<tr>
<td>Twin (Ormco Miniline)</td>
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<tr>
<td>Twin (“A” Company Damon)</td>
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times greater friction. The active self-ligating bracket exhibited 216 times greater friction. If the object is to remove friction from the system, passive self-ligation has a tremendous advantage over conventional ties as well as active self-ligation.

Before I began using my current mechanics, if a tooth didn't move, the first thing I thought of was increasing the force instead of looking for a problem in the mechanical system. When you multiply the friction of conventional mechanics and even active self-ligation brackets on a single tooth by the number of teeth in the arch, you can make the case that our urgency to get into the larger size wires was directly tied to our need to overcome the friction in the ligating system. The wires had to exhibit enough force to overcome this friction. We now have a great deal of information about how teeth move, yet what we do clinically seems to contradict what we know about the cellular biology of tooth movement. We determine our archwire sequencing based on “what we can get in,” which really means “what the patient can tolerate” rather than the effect the archwire might have on the cellular biology of tooth movement. There have been many attempts to minimize treatment forces, such as Burstone mechanics and the use of the .018 slot; however, the major culprit, in my opinion, is friction. The number one enemy to efficient, biologically compatible tooth movement in clinical orthodontics is the way archwires are tied. If we can decrease friction and lower force levels, we can change the dynamics of tooth movement.

Damon System II and Low-Force Wires: A Ferrari and Its Fuel

The Damon System II appliance system works in conjunction with low-force wires much as a Ferrari is fueled by high-octane gas. Both work for greatest performance when used as a system. My protocol requires three archwires (Figure 2). I will speak specifically about the .022 lumen because I have found it to be the most advantageous in my hands. Archwires are selected to allow play in the mechanical system – play that dramatically improves the chance of staying in the previously mentioned Biozone. The first wire, an .014 Align™ SE nickel titanium, is the heart and soul of the system. The .025 dimension is the key because, along with the usable width of the bracket, it is the fit of that dimension into the .027 slot depth that dictates rotational control. In passive self-ligation, rotational control is affected by three things: (1) depth of the bracket slot; (2) usable width of the bracket; and (3) horizontal archwire dimension. Rotations are not removed by placing the archwire against the back of the slot. Doing so negates the intent of the passive self-ligating system and would approximate the detrimental effects of friction in conventional bracket systems and in active self-ligation. Keeping the amount of play between the depth of the slot and the depth of the archwire within a specific range is critical to rotational control. Having .022" to

Figure 2. Archwire sequencing.

<table>
<thead>
<tr>
<th>.018 Slot</th>
<th>.022 Slot</th>
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<tbody>
<tr>
<td>.014 or .012 SE NiTi</td>
<td>.014 or .012 SE NiTi</td>
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<tr>
<td>.014 x .025 SE NiTi</td>
<td>.016 x .025 SE NiTi</td>
</tr>
<tr>
<td>or .014 x .025 SE NiTi</td>
<td>or .014 x .025 SE NiTi</td>
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<tr>
<td>.016 x .025</td>
<td>.019 x .025</td>
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<tr>
<td>Pre-Posted SS</td>
<td>Pre-Posted SS</td>
</tr>
</tbody>
</table>

The second archwire, an .016 x .025 Align SE nickel titanium, is the heart and soul of the system. The .025 dimension is the key because, along with the usable width of the bracket, it is the fit of that dimension into the .027 slot depth that dictates rotational control. In passive self-ligation, rotational control is affected by three things: (1) depth of the bracket slot; (2) usable width of the bracket; and (3) horizontal archwire dimension. Rotations are not removed by placing the archwire against the back of the slot. Doing so negates the intent of the passive self-ligating system and would approximate the detrimental effects of friction in conventional bracket systems and in active self-ligation. Keeping the amount of play between the depth of the slot and the depth of the archwire within a specific range is critical to rotational control. Having .022" to

Figure 3. Engaging a high cuspid.

Case started with an .014 Align SE nickel titanium archwire in .022 slots.

First return appointment 10 weeks into treatment. Note very little impact on adjacent teeth as cuspid moves into position.
.003” of play across the full depth of the bracket is paramount. Realizing that this dimension is critical to rotational control, we have not only reduced the depth of the archwire slot in the Damon System II from .028 to .027 but also tightened the allowable manufacturing tolerance, offering control even beyond that of the Damon SL. I have seen evidence that this control is far superior to what can be achieved with conventional ties.

It is imperative that we finalize rotations during this stage before moving to the final archwire. Being able to do so illustrates the remarkable control of the system. We have all had to go to lighter archwires near the end of treatment to make final rotational adjustments. If the appropriate amount of control had been provided with conventional brackets, it would not have been necessary. When we do, we reintroduce the breakdown and buildup of bone tissue just at the point when we want to be stabilizing it. Most of us agree that the longer we can maintain a tooth in its final position, the more stable it will be. Getting the rotations worked out at this second stage is the key to later stability.

At the first return appointment after placing the second archwire, we take a Panorex to carefully evaluate root and bracket positioning, then make any adjustment to bracket placement. With the second wire, we are also continuing to level and develop the arch form. I let this wire work to its fullest before going to the stainless steel wire. Our intention is for the stainless steel wire to go in nearly passive, with minimal discomfort to the patient. The third and final wire, the pre-posted stainless steel wire (.019 x .025), is for all our major mechanics and finishing. It completes the torquing and leveling while helping to control the vertical dimension during major mechanics.

Appointment intervals are critical. What we find is that the teeth move more efficiently if we are not continually interrupting the force levels. According to Proffit, “Activating an appliance too frequently, short circuiting the repair process, can produce damage to the teeth or bone that a longer appointment cycle would have prevented or at least minimized.” Because the wonderful technology of these wires will work over an extended period of time, we have, with appropriate patient compliance, moved our appointment cycle to 10 weeks, allowing the wires to work to their fullest expression. This minimizes discomfort to the patient and actually allows the teeth to move at a more rapid, yet biologically sound, rate.

Sliding Mechanics: More Than Space Closure

We all use sliding mechanics, but when we think of sliding mechanics, we often think primarily in terms of closing space. Sliding mechanics also comes into play in many other aspects of tooth movement: engaging a high cuspid, dealing with rotations, in-out discrepancies, leveling and, when desired, changing arch form.

Engaging a high cuspid. In engaging a high cuspid, the wire obviously has to slide through the rest of the braces for the cuspid to move into position. When using a conventional bracket system in the maxillary arch, the lateral incisor and first bicuspid have a tendency to move superiority while the cuspid is moving into position. In a low-force, low-friction system, cuspids travel into position with very little negative impact on the adjacent teeth (Figure 3).

continued on following page
Leveling. Leveling is one of the greatest challenges we face in orthodontics and it, too, involves sliding mechanics. With conventional braces, we're continually using reverse curve archwires, bite plates and Bite Turbos to level cases. Light forces used in this virtually friction-free environment have nearly eliminated the use of auxiliary appliances in our practice. With this technology, cases are level by the time we come out of the second archwire (Figure 4).

Rotations. Obviously, for teeth to rotate they must slide along the archwire. A good example of rotations being eliminated is depicted in Figure 5.

Arch Form: Muscles of the Face and Posterior Expansion

One of the most surprising developments I’ve found in using this bracket system in conjunction with very light wire forces is the impact the facial muscles have on aligning teeth and arch development. Much to my amazement, when using .012 or .014 Align SE wires to align teeth in cases where the patient’s profile dictated nonextraction, the orbicularis oris and mentalis muscles maintained the AP position of the upper and lower incisors with minimal change in incisor position. It appears to me that the teeth seek the path of least resistance, which translates into posterior expansion (Figure 5). When I started cases with .016 Align SE or stronger, I found a dramatic increase in patient discomfort along with the negation of the above advantages. The only time that I don’t see AP position reasonably maintained is in cases with very flaccid lip musculature.

Let me explain where I’m coming from on this issue of posterior expansion. When I first got out of my residency, I was extracting in a high percentage of my cases. In determining treatment plans at that time, we had to factor in space not only for the teeth to unravel but also for the bands on all teeth; hence, extraction was a more common practice. There was also the assumption that extractions led to greater long-term stability. In following those cases over time, I began to see dramatic changes in facial profiles as adolescents matured. Many profiles that looked great at 12 to 14 years of age looked dished by ages 20 to 25. I was very unhappy with many of my patients’ profiles when the nose and chin matured. I was also dismayed by the relapse I was seeing even in some extraction cases retained as recommended in my training.

About the same time, a long-term retention study was being conducted at the University of Washington. I spent many hours studying cases out of treatment 20 years and more. What impressed me over and over again was my inability to determine which cases were going to be stable and which were not, regardless of whether the case was treated with extraction or nonextraction. Some cases were stable both in the study and in my practice. The problem was defining the relapse potential of each patient.

After much soul-searching, I came to the conclusion that I did not have the ability to pick which cases would be stable. This led to the philosophical decision to recommend permanent retention in all
cases, regardless of treatment protocol. I then reasoned that if permanent retention were required and extraction did not necessarily ensure greater stability, I could shift some of the cases I was treating extraction toward nonextraction, paying greater attention to the maturing profile. I want to emphasize that I am not against extracting teeth, it’s just that I’ve been more selective since then about using that treatment protocol. Bonding brackets on most of the teeth helped me move the curve even further toward nonextraction.

This new low-friction, low-force technology has expanded my treatment planning options even more. Those of us using the system see a dramatic change in the way the alveolar process reactivity to light force mechanics. Many orthodontists accept posterior expansion with a quad helix, W-arch, Schwarz plate, lip bumper, Fränkel or surgery. Orthodontists who use these techniques know that the muscles of the face must adapt to the orthopedic changes for the case to be stable and, to different degrees, most do. Until now, most clinicians have been reluctant to expand the posterior arch with archwires and for good reasons – because of not only the potential for dumping anteriors but also the unwanted possibility, specifically in the lower arch, of pushing the teeth through the cortical bone. The cases in Figure 5 are good examples of what those of us using the system are seeing with the new technology. Rygh, in his research, commented that light continuous forces ensure more effective tooth movement in areas with cortical bone or bone with few marrow spaces. In other words, it doesn’t interrupt the vascular supply. Could it be that our mechanical system with its bound-up brackets and archwires has compelled us to use higher forces than are compatible with the low vascularity in the alveolar cortical plate? If posterior expansion with archwires is a blood supply issue and the clinician places low-friction, low-force mechanics, what is the difference between expansion using devices that most orthodontists accept and expansion using archwires? These comments are from clinical observations; obviously, this area needs much research.

**Low-Friction, Low-Force Mechanics: Impact on Extraction Cases**

Even in extraction cases, I have found that the muscles of the face become our great allies in aligning teeth with minimal or no demand on posterior anchorage. I am struck by the performance of .014 Align SE wires in severely crowded cases. Instead of the anteriors dumping forward, these light forces allow the orbicularis oris and mentalis muscles to maintain the AP position of the incisors while the crowding seeks the path of least resistance, which is into the extraction sites (Figures 6-7).

**Quality, Time and Comfort**

We all know that our primary focus should be the quality of care we give our patients. Any new treatment system must first equal or exceed our expectations for the finished result. With that being our primary focus, it is important to keep in mind that our patients have become aware of two other key issues: time and comfort. One of the most precious commodities in everyone’s
Here we go again, another Class II corrector. The only difference is that this appliance reliably corrects Class II malocclusions in a timely manner, is simple to use, comfortable, cost effective, breakage resistant and of course requires no patient cooperation. The appliance is called the Bite Fixer. Many of you may have used noncompliance Class II correctors such as Jasper Jumpers in the past and, if so, may have experienced the frustration of continual breakage. Some of you probably discontinued using such appliances. It’s been frustrating for me as well. Those of us who were committed to the concept of a fixed spring, Class II corrector improved our techniques to make repairs quickly and kept on trucking. In fact, a number of protocols I use for the Bite Fixer are techniques Dr. Jasper recommended for his fixed spring appliance. The reward has been being able to treat Class II malocclusions successfully, eliminating the patient cooperation requirement and reducing overall treatment times.

When Ormco asked my assistance in testing their new fixed spring appliance, the Bite Fixer, I was eager to do so. Over the next couple of months I noticed we were experiencing limited-to-no breakage and the children were tolerating the appliance well. The corrections were effective and were occurring in less time because there were no setbacks due to breakage. In addition, the spring was designed with a plastic insert to keep hygiene issues at a minimum. What I have found using a fixed spring appliance for the last eight years is that the Bite Fixer is as effective as any Class II corrector I have ever used and is simpler and more reliable, time efficient and cost effective than any other device of its type. See the illustrative case on the facing page.
Bite Fixer Indications
It is difficult to determine who will be a good cooperator and who won't. My philosophy is to treat every patient who fits the following criteria with a Bite Fixer. I rarely give the patient the benefit of the doubt by starting with elastics, much less headgear, only to have treatment times increased through poor cooperation. One other key consideration is that I start adolescent patients when the majority of permanent teeth have erupted and 12-year molars can be banded.

Class II malocclusions due to mild and moderate mandibular deficiencies. Treating these malocclusions requires mandibular growth to achieve a Class I relationship. Improving the sagittal relationship of the mandible to the maxilla enhances the patient's facial balance and creates what Dischinger describes as a Class I face. Research has shown that we are able to achieve some mandibular growth with this type of appliance, and I have observed these effects clinically and through cephalometric X-rays. The skeletal effects are produced by a bite-jumping mechanism similar to those experienced with the Herbst* and functional appliances.

Class II, division 2, malocclusions that tend toward a Class I skeletal relationship. These patients have a relatively balanced profile, deep incisor overbite and a low mandibular plane angle (Figure 1). Growing or nongrowing patients can be treated rapidly.

* Herbst is a registered trademark of Dentaurum, Inc.
and effectively with the Bite Fixer because of minimal anchorage requirements and the fact that it is primarily dentoalveolar movements that are needed to achieve a Class I dental relationship. The Bite Fixer produces a “headgear” effect on the maxillary dentition and an anterior, intrusive force on the lower dentition. The same results have been documented with the Herbst appliance in the successful treatment of Class II, division 2, malocclusions.7

Class II malocclusions due to skeletal or dentoalveolar asymmetries. It is my experience that the majority of these asymmetries are mandibular in nature. These cases are more difficult to treat conventionally because asymmetrical mechanics require a tremendous amount of patient cooperation. By applying force from the Bite Fixer to the Class II side and maintaining it passively or eliminating it on the Class I side, you can effectively treat this type of malocclusion with minimal effort (Figure 2). Asymmetrical dentoalveolar movements can also be easily achieved by cinching back the wire on the Class I side and allowing the posterior segments to freely distalize on the Class II side.

Mild-to-moderate Class II, division 1, malocclusions with vertical maxillary excess, resulting in a downward and backward rotation of the mandible. Unlike Class II elastics, which exhibit unwanted extrusive forces on mandibular molars, the Bite Fixer applies intrusive force to the maxillary posterior segments, which is beneficial to the successful treatment of mild-to-moderate high-angle Class II malocclusions. The intrusive forces to the upper molars help facilitate bite closure by autorotating the mandible. These cases usually require only 8-10 months of Bite Fixer therapy.

Class I crowded malocclusions that may require the extraction of permanent teeth. The Bite Fixer can be quickly constructed to move single or multi-units of teeth, making it ideal for these cases. Much like headgear, it can be used to obtain maximum anchorage, holding the upper molars back as the upper incisors are retracted. These movements can be achieved quickly, usually with 3-4 months of force activation, and with minimal anchorage loss in the lower arch.

Class III malocclusions with mild maxillary deficiencies. The Bite Fixer can also be used in Class III malocclusions when maxillary protraction is required. This is impossible with the Herbst appliance.

Poor Candidates for the Bite Fixer

Mild-to-moderate Class II malocclusions in the early mixed dentition. Proper anchorage preparation is critical to achieving a successful result. It is best accomplished after the majority of permanent teeth have erupted. I have found that treating cases in one phase, after children begin their most rapid period of growth, dramatically improves results; thus, I do not use the Bite Fixer in

Figure 2. Asymmetrical Class II case with a severe midline discrepancy. The day the Bite Fixer was first placed (above). The day the Bite Fixer was removed, 9 months into treatment. The case is now ready for finishing elastics (below).
the mixed dentition. The literature shows that girls experience their most rapid growth between the ages of 11 and 14; boys, between 12 and 16. My best results suggest waiting for the majority of permanent teeth to erupt, then initiating treatment around age 11 or 12. Pancherz and Hagg found that starting patients within this time period dramatically increased the condylar growth response.

Class I or II malocclusions with severe maxillary protrusion in the early mixed dentition. I have had the best results treating severe maxillary protrusive, early mixed dentition cases with headgear rather than the Bite Fixer to avoid unwanted dental movements that can occur, especially without proper anchorage. The little early treatment I do in my practice I reserve for anterior and posterior crossbites with functional shifts, severe anterior diastemas that are preventing the eruption of maxillary laterals, ectopically erupted first molars, thumb and finger habits and severe maxillary protrusion which could result in dental trauma. I manage crowding in the early mixed dentition by extracting the primary canines and placing these patients on recall until the permanent teeth have erupted.

Treatment of severe skeletal Class II malocclusions due to mandibular retrognathia, vertical maxillary excess or a combination of both. I treat the majority of these patients surgically. It is my experience that treating these patients with a Bite Fixer or any other type of Class II corrector will fail.

Nongrowing patients requiring mandibular lengthening to achieve a Class I relationship. The changes that occur in this group will be mostly dentoalveolar, so I remove the maxillary first bicuspids or treat the case surgically.

**Anchorage Preparation after Aligning and Leveling**

It is my experience that the majority of Class II malocclusions require some maxillary expansion to allow the mandible to function forward without going into an end-on, cusp-to-cusp relationship or, in severe situations, a posterior crossbite. In the majority of moderate Class II cases, I place full appliances and an RPE at the same appointment. I utilize an .018 slot Orthos bracket system with triple buccal tubes on the upper first molars and double buccal tubes on the lowers. After 7-14 days of expansion, I began aligning and leveling with an .016 nickel-titanium Orthos archwire. I align, level and decompenstate both arches for approximately 6-10 months, depending on the degree of misalignment, before placing the final wire and activating the force module. In Class II extraction cases requiring mandibular growth, I close all spaces before placing final wires.

After aligning and leveling is complete, I place an .017 x .025 or .018 x .025 stainless steel archwire, depending on my anchorage requirements. Fully engaging the brackets in both arches, especially the lower, maintains anchorage during the activation of the force module, preventing unwanted mesial movement of the lower incisors and distal movement of the uppers. The Orthos prescription that I use also contains 5º of lingual crown torque, which is useful in fully engaging the lower incisor brackets. In Class II, division 2, malocclusions where proclining the lower incisors may be advantageous, I use an .016 x .022 stainless steel archwire as my final wire before Bite Fixer therapy.

The final wires are placed approximately 8 weeks before placing the force module. I have found that placing heavy archwires and force modules the same day creates too much discomfort. It is also important to allow the teeth to adapt to the new wires for at least 8 weeks prior to force activation, keeping discomfort to a minimum and improving treatment success.

Because I use an auxiliary archwire to attach the Bite Fixer to the lower arch, at the placement appointment it is imperative to have an assistant tie steel ligatures tightly around the mandibular first and second premolars. Failure to do so makes it nearly impossible to retie those brackets without removing the entire auxiliary wire.

I prefer to have second molars banded to improve anchorage and aid in preventing expansion of the posterior buccal segments. I will not, however, delay treatment for second molar eruption, especially for the patient I suspect is beginning the pubertal growth spurt. Some buccal expansion in the upper and lower arches is to be expected, and placing bands on the second molars will aid final alignment.

Another adjunct to help control anchorage in Class II patients when mandibular growth is needed is cinching back the maxillary archwire. Maintaining an RPE or placing a transpalatal or lingual arch during the force activation stage will help control unwanted buccal expansion of both arches. I prefer to constrict the upper and lower archwires to control transverse expansion. Using additional hardware in conjunction with the Bite Fixer is unnecessary. One of the great advantages of this system is its ability to keep mechanics simple and finish with a nice result.

The force modules can be placed once all these steps are completed.

- Both arches are properly aligned and leveled.
- Both arches are completely decompenstate.
- Brackets are fully engaged with stainless steel archwires (cinched back in the upper arch if mandibular growth is needed).
- Adjuncts are added to help maintain anchorage.
- Steel ligatures are placed around the lower premolars.

At this point, I place the Bite Fixer (3-4 minutes of doctor time).

**Attachment: Sectional Wire Strongly Recommended**

I am indebted to Dr. H.O. Blackwood of Shreveport, Louisiana, for his unselfish guidance during a study club lecture (while I was still a resident at LSU) on employing the most advantageous means of attaching a fixed spring Class II corrector – through use of an auxiliary wire. There are three primary ways...
to attach the Bite Fixer to the lower arch.
• Attach the force module directly to the lower archwire between the first premolar and canine brackets (Figure 3).
• Remove either or both premolar brackets and place step-out bends distal to the cuspids.
• Use a sectional archwire attached to the lower first molar and lower archwire (Figure 4).

There are several advantages in using sectional archwires.

• Sectional archwires can be pre-bent, saving time (Figure 4).
• Premolar brackets do not have to be removed, which helps support anchorage.
• Because the Bite Fixer is allowed to slide freely along the auxiliary wire, a patient’s range of motion is greatly increased, thus decreasing the likelihood of breakage (Figure 5).
• If breakage does occur, it is usually the auxiliary wire and replacing it can be accomplished simply and quickly without removing the lower archwire.
• Anchorage is increased, which aids in preventing the lower incisors from proclining. Because the auxiliary wire is cinched back distal to the mandibular first molar bracket and the anterior component is placed centrally between the premolar and canine bracket, the forces exerted on the lower arch are distal to the mandibular first molar rather than to the lower incisor.

To attach the Bite Fixer using an auxiliary wire, use an .017 x .025 stainless steel sectional archwire looped between the first premolar and canine bracket and cinched back through the auxiliary tube on the lower first molar band. (The lower first molar band will require an auxiliary slot; i.e., a double buccal tube.)

Bending the Auxiliary Wire. First, place a loop at the end of an .017 x .025 stainless steel archwire and a 90° bend approximately 5 mm from the end of the loop (Figure 6). Bend one auxiliary wire to fit the left and one to fit the right (Figure 7). I distinguish the difference by making sure the open end of the auxiliary points downward, toward the gingival, with my step-outs toward the buccal. Since pressure from the Bite Fixer applies an intrusive force to the lower arch, doing this helps the auxiliary stay securely attached to the lower archwire if the loop were to open. Slide the acrylic bead onto the auxiliary wire (Figure 8), then make the final 90° bend. The step-out bend should approximate a thumb’s width for nonextraction cases and a finger’s width for extraction cases (Figure 9). The acrylic bead provides a stop to prevent the Bite Fixer from sliding mesially against the canine bracket. To minimize breakage, use an .017 x .025 sectional archwire.
The step-out bend allows the Bite Fixer to slide freely as patients open and close their mouths (Figure 10). This will improve the patient’s range of motion and decrease the stress that could otherwise be placed on the appliance (Figure 5). You are now ready to attach the Bite Fixer.

**Placing the Bite Fixer**

Having used this type of appliance for eight years, I find two sizes work in most cases. Smaller arches use size 3 and larger arches use size 4. You will seldom use size 5 unless you treat horses. Ormco realized this fact and supplied Bite Fixer kits primarily with sizes 3, 4, and only a few 5s. To minimize breakage, use the recommended measuring procedure until you are proficient with the appliance.

After choosing the proper size, slide the right Bite Fixer onto the right auxiliary wire and the left onto the left. Using a Weingart, slide the auxiliary wire into the auxiliary slot on the lower first molar and then attach the anterior loop between the first premolar and canine brackets. When you cinch back the auxiliary wire, make sure the anterior loop is placed between the first premolar and canine brackets and not directly against the canine bracket. Secure the auxiliary by crimping the anterior loop around the lower archwire. Let me warn you that if you have the right Bite Fixer on the left side, you will have to remove the auxiliary wire and start over. This is time consuming, trust me!

The final step in attaching the Bite Fixer and activating the force module is placing the ball pin through the distal end of the Bite Fixer’s end cap. The ball pin is then fed anteriorly through the distal end of the headgear tube of the upper first molar, making a loop to anchor it in position (Figure 11). Allow the ball pin to protrude distally a few millimeters beyond the end of the headgear tube to allow the Bite Fixer to move freely, providing leeway for future activation, if needed.

**Activation after Placement**

I maintain the appliance in a passive position for the first activation immediately after placement. To remain passive, the Bite Fixer should bow slightly toward the cheek when the patient closes in centric relation (Figure 12). Activating the appliance at placement usually results in one of two outcomes: (1) the parents bring the child back to the office, usually that same day, to have the appliance removed because of pain; or (2) the patient purposely breaks the appliance or the set-up. Allowing the patient to adapt slowly to the appliance improves treatment success. I schedule the first return appointment after initial activation in approximately 8 weeks. At that visit, I activate the appliance. Although there is no data to confirm my protocol, I have found that activating the appliance and applying a light continuous force has proven to be successful.

Communication after placement. Besides care of the appliance, the most important thing to tell patients is to avoid opening their mouths too widely. This could result in breakage. The “stretchability” of the spring allows the patient a wide range of motion; however, there is still the possibility of breakage if a patient mistreats the appliance.

Activating the appliance to achieve orthopedic changes. After the patient is retied, I activate the appliance by pulling the ball pin anteriorly with a Weingart and placing an additional loop in the ball pin. If attempting to encourage mandibular growth, I want to achieve a bite-jumping effect. To do so, I activate the appliance at the first return appointment by having the patient position the jaw forward from centric relation to centric occlusion. In centric occlusion, there should be a slight bow in the force module. When the patient closes in centric relation, the contour of the bow should be significantly increased (Figure 13). By slightly overactivating the appliance in centric relation, the patient will automatically position the mandible forward. I feel this is a natural response to decrease the force module and alleviate pain. Make sure the upper archwire is cinched back to increase
Subsequent Reactivation Visits

At subsequent visits, ensure the ball pin has not been bent too far gingivally. If the ball pin is excessively bent, you may want to replace it or bend it down, parallel with the occlusal plane. Check also that the auxiliary wire is still secure and not resting against the canine bracket.

Activation for orthopedic changes.

When encouraging mandibular growth, you will not need to reactivate the appliance. You should note that at this point the patient is functioning forward involuntarily. Manipulate the lower jaw back into centric relation by having the patient position the tongue posteriorly to the roof of the mouth, closing lightly. You will notice over the next subsequent appointments that it will be harder to manipulate the lower jaw posteriorly because you are achieving correction. I will normally leave the force module in place for 8-10 months. I like to overcorrect slightly and hold this position for several appointments before removing the appliance.

Activation for dentoalveolar movement.

If dentoalveolar movements are needed to achieve a Class I relationship, I reactivate the appliance when the posterior segments move distally and the force module becomes passive. You will notice movement soon after the first activation appointment. Once the molars are in a Class I relationship, the force module can be left in place for anchorage to retract premolars, canines in extraction cases or anteriors en masse by placing elastomeric chain from those teeth to the first molar or ball pin. Since the upper archwire has not been cinched back, the molars can move distally, potentially disengaging the molar bracket. If left unnoticed, the molars will rotate distolingually and expand buccally. You will then have to remove the Bite Fixer.

Overactivating the appliance. I learned through trial and error to avoid pulling the ball pin directly against the distal end of the headgear tube. This prevents the Bite Fixer from rotating buccally when the patient closes. This rotation is very important because it allows the Bite Fixer to be deflected toward the cheek, preventing the patient from chewing on the appliance and possibly breaking it.

Troubleshooting size. If the ball pin is placed directly against the distal of the headgear tube and there is no activation in the force module, choose a larger size. If the appliance is excessively deflected against the cheeks and the bow is over-contoured, you have either overactivated the appliance or the size is too large for the patient's mouth. Overactivating the force module greatly increases the potential for breakage.

The Bite Fixer Brings Dependable Performance to Noncompliance Class II Therapy

Engineered for durability, the Bite Fixer has outperformed competitive appliances in extensive clinical trials and has done so with minimal breakage. Consider the benefits of the Ormco Bite Fixer.

- Crimpable lower attachment is simple to place.
- Strong, reinforced components of thoughtful design ensure efficient performance.
- Since the spring is attached and crimped to the end fitting, breakage between the spring and end fitting is virtually eliminated.
- Polyurethane tubing inside the spring prevents it from becoming a food trap.
- Stretchability of the spring allows freedom of movement, making it comfortable and minimizing breakage.

If you'd like to put the fix on noncompliance Class II correction, see the ordering information on page H of the Center Section or drop by the booth at the AAO in San Diego.
and recapture the molar before proceeding. To preclude this, always have an assistant ensure that the upper archwire is long enough to accommodate the distal movement of the molar. After the final wires are placed, leave a little wire hanging out of the back of the upper first molar bracket. Four to six months of activation with the Bite Fixer is needed for proper distalization.

Treatment Effects
Unlike Class II elastics, which produce extrusive forces on the lower molars, the Bite Fixer produces intrusive force on the upper molars. This treatment outcome is beneficial in treating high-angle Class II malocclusions. If you have used the Herbst in your practice, you will experience the same posterior open-bite pattern with the Bite Fixer (Figure 14). The open bite will close naturally or with the assistance of elastics. Some overcorrection will also be noted. Because the force module is deflected buccally, I have also experienced some transverse expansion in the upper arch. Since the majority of Class II malocclusions need some expansion in the upper arch, this effect is beneficial.

The only unwanted movement I have experienced is buccal expansion in the lower arch, especially when the second molars have not been banded. Because the point of attachment of the auxiliary wire is distobuccal to the mandibular first molar, as force is applied anteriorly, there is a tendency for the molar to rotate mesiobuccally, causing a mild posterior crossbite. This is quickly remedied after the appliance is removed and second molars are banded. I see this response primarily when treating moderate Class II skeletal patterns for many months or

in patients with a high-angle Class II skeletal pattern. Quite often, a high-angle Class II patient will have worn down the occlusal table significantly. With open-mouth posturing and weaker biting forces that are often found in Class II patients, loss of occlusion adds to instability, especially in the transverse dimension. This treatment consequence, however, has not affected final treatment results.

“The Bite Fixer has reduced treatment times by increasing reliability and minimizing breakage.”

The most unwanted dental movement is proclining lower incisors, especially in Class II, division 1, malocclusions. The key to improving facial balance is to avoid proclining the lower incisors while attaining mandibular growth. I have yet to experience unwanted incisor movements that have prevented me from achieving a nice result. I have two explanations for this. First, I am conscious about preparing anchorage properly and fully engaging the lower incisor brackets. Second, and probably more significantly, as the patient chews in centric relation, the force module is fully activated, applying the maximum force to the lower arch. At this point, mostly dentoalveolar movements are experienced with a greater likelihood of proclining the lower incisors. On the other hand, as the patient positions forward into centric occlusion, the force module remains passive, applying little or no force to the lower teeth. If both arches are well aligned and uncompensated, the patient will easily position the lower jaw forward, decreasing the force and unwanted pain. At this point, the patient is experiencing mostly orthopedic effects with minimal proclination of the lower incisors.
Introduction
Orthos** was introduced in 1994. The first published article about it was a 1994 JCO interview of Dr. Craig Andreiko by JCO editor Dr. Larry White. Since that time, the appliance system has enjoyed steady growth and become a worldwide leader. In this article, I’m addressing the questions that I posed to myself before becoming involved in Orthos’ clinical investigation: Is its clinical performance significantly superior to that of the other preadjusted appliances? Can Orthos make a dramatic difference in helping me achieve my practice goals? I practiced 12 years with an excellent preadjusted appliance, one that is highly popular today, and I was not interested in changing my established technique for the sake of marginal improvements. So I can best demonstrate what Orthos has added to my practice by describing its contributions to clinical performance and achievement of my practice goals.

If You Don’t Know Where You’re Going, How Do You Know When You’re There?
As orthodontists, we are truly blessed to be in such a great profession. We are also charged with the responsibility of delivering the best smile possible to every patient. I’ve truly enjoyed building my practice, and I attribute the enjoyment and success that I’ve experienced to establishing specific priorities and goals, working to achieve them and constantly measuring my performance against them. As I share my goals with you, I imagine many of you will find them consistent with your own.

First, I have a mission statement:
1. I will deliver the best orthodontic care available in the cities that I serve.
2. That care will be provided in a manner that will be recognized by both the patient and/or parents as the best there is. The relationship of my office to each patient is vitally important to the continued growth of my practice.
3. I will provide that care to an ever-growing number of patients.
4. I will make a reasonable profit.

My practice goals are separate from my mission statement, yet totally connected:
1. Produce consistent, predictable, high-quality orthodontic results.
2. Start all the cases I care to start.
3. Make a reasonable profit.
4. Practice with great efficiency.
5. Have fun.

Note that profitability is on both lists.

* Products identified as “Orthos” are distributed in Europe as “Ortho-CIS.”
Profitability, Time and Efficiency
I’ve found three key factors to profitability:
• Efficiency of mechanics
• Decreased chairtime per office visit
• Fewer appointments to complete treatment

We as orthodontists need to realize that we do not sell braces. We sell our time! What has made orthodontics more profitable, less tedious and less time consuming for the orthodontist and less costly, more pleasant and less time consuming for the patient are the great advances in these key factors. Variable modulus mechanics with space-age wires have certainly added much to practice/time efficiencies. Just how much of a contribution does Orthos have to offer? In the past, the best orthodontic results and the most profits were achieved by the best wire benders. Now, and in the future, the best orthodontic results and the most profit will be achieved by those of us who can best position the most efficient brackets.

Treatment Goals
Will Orthos make a major contribution in helping you achieve your treatment goals? As a firm believer of “Begin with the end in mind,” I have established a set of treatment goals and have found Orthos to be of tremendous benefit in achieving them:
• Use nonextraction treatment when possible.
• Establish a balanced soft tissue profile.
• Place all mandibular teeth in the center of the cancellous bone of the mandible (the Mantroff, in Orthos terms).
• Construct the maxillary occlusion to the ideal placement of the mandibular teeth.
• Establish proper root positioning.
• Upright mandibular molars both mesiodistally and buccolingually.
• Establish Class I molar and cuspid occlusion.
• Establish ideal overjet and overbite.
• Produce a functional and stable final occlusion.

With Orthos, I have been able to achieve my treatment goals more consistently and efficiently. Achieving these goals more easily has had a most welcome effect on profitability. To understand Orthos effectiveness, let’s take a look at its etiology and rationale.

Orthos - Scientifically-Derived Arch Form and Appliance Prescription
My history with Orthos dates back several years prior to its introduction. Dr. Andreiko and Mr. Mark Payne ofOrmco contacted me about testing the clinical performance of Orthos’ progenitor, a patient-specific appliance system. As mentioned earlier, I was happy with the preadjusted appliance I was using, but I was excited by the depth of Ormco’s scientific methodology and the opportunity to participate in the development of a potentially major advancement in orthodontic appliances. And for me, the combination of the new space-age arches and the ultimate product of the research, Orthos, has represented a true paradigm shift in orthodontic treatment.

The Patient-Specific Appliance Investigations
We began the project with five basic concepts:
1. Skeletally, the mandibular teeth should be contained and aligned within the alveolar bone of the mandible. That is, centered in the mandibular trough – Mantroff (Figure 1).
2. Mandibular buccal cusps must align incisogingivally to produce a flat mandibular occlusal plane.
3. Mandibular buccal cusps must align buccolingually with the central grooves of the maxillary teeth to produce centric stops.
4. Maxillary central grooves define the buccolingual location of centric stops for the buccal cusps of the mandibular teeth.
5. Maxillary marginal ridges are the centric stops for the buccal cusps of the mandibular teeth.

As basic and logical as the concepts appear, analysis of preadjusted appliances other than Orthos reveals that these considerations were not studied to the degree now possible with current technology.

Space does not permit a step-by-step description of the derivation of the patient-specific appliances, but I will touch on a few key points. An extremely accurate scan of each tooth (Figure 2) from the maxillary and mandibular models is entered electronically into the computer from which the cross-sectional labiolingual profile of each tooth is determined, and landmarks and measurements of each tooth are automatically determined by the design software. Next, the Mantroff is determined from a laser scan of the mandibular model. Each mandibular tooth is rotated and torqued by the software to its optimum position in the mandibular arch. The teeth are then placed into the Mantroff. The next step involves the computer derivation of the “Best Fit Buccal Cusp Equation” (BFBCE), which precisely describes the location of the buccal continued on following page
Dr. Scott
continued from preceding page

cusps of the mandibular teeth in the Mantroff (Figure 3).

Next, the maxillary teeth are placed over the ideally located mandibular teeth by the software to construct the final occlusion. The maxillary 1st molars are positioned first, with the molars rotated so that they occupy the least amount of space in the dental arch. Then the mandibular 1st molars are placed into ideal occlusion with them. The remaining maxillary teeth are positioned in a similar fashion. The long axis of each maxillary and mandibular tooth is placed in its proper axial inclination, buccal cusp tips of mandibular teeth are occluded ideally with marginal ridges of maxillary teeth, and cuspid rise occlusion is established. At this point, the computer has an exact mathematical model from which it can design the ideal appliances – the ultimate example of beginning with the end in mind!

Ideal archwire planes are determined with respect to each individual tooth so that the proper torque and bracket slot height can be determined for each tooth. After determining the proper offset angles for the molars, along with their individual slot heights, the computer software places “virtual brackets” on the ideally positioned teeth (exact duplicates of these brackets are made for the patient) (Figure 4). Next is the derivation of a smooth arch form that will pass through the bodies of the brackets (virtual slotless brackets at this point). The computer considers thousands of possible combinations until the one ideal arch form is constructed. At this point, the ideal patient-specific appliance has been created for the patient. Each individual tooth has its own bracket with the ideal torque, in-out, axial inclination and bracket height as determined by the computer.

Patient-specific brackets are machined (slots cut) from bonding assemblies that are complete except that they have no archwire slot. This procedure allows specific appliances that even have the radius of the archwire incorporated into the slot. Next, the software generates a set of patient-specific archwires according to the data obtained from the patient analysis and in accord with the orthodontist’s preferred archwire sequence. The final laboratory procedure involves manufacturing placement jigs to accurately position each bracket (Figure 5). This process uses the computer data showing the labiolingual profile of each tooth.

After seemingly endless laboratory work and rethinking of procedures, the clinical trials began. Over 100 cases were in the evaluation, of which I treated 67. About 20 months into the trials, the first patient-specific cases began finishing treatment. The clinical results were outstanding!

Translating Patient-Specific Findings into the Orthos Appliance
All along, the research team and clinicians noticed that the patient-specific prescriptions varied considerably from those of existing preadjusted appliances. As stated earlier, the patient-specific appliance is the ultimate example of beginning with the end in mind. The individual prescription for every patient treated was studied. Each tooth for each patient was analyzed as to torque value, axial inclination, in-out and slot height. Another finding was that the arch forms varied significantly from the popular forms in use. It was decided to take all these cases and look at the averages of all the data determined from the analysis. The findings led to the development of Orthos.

Previous preadjusted appliances had been developed from studies that were as good as could be done at the time with the use of millimeter rulers, Boley gauges, magnifying glasses and “good old clinical judgment.” The data obtained with computer scans and modeling of occlusion and measurement capabilities accurate within .001” revealed that the preadjusted systems then available were lacking in accuracy. The need for a scientifically derived, more precise average appliance was obvious. Thus, the birth of Orthos.

Is there any one thing about Orthos that makes it so much different or better? No, but there are many things that are just a little different. The torque values differ here and there. So do the bracket slot heights and the axial inclinations of various teeth. And the Orthos arch form differs from all others. Orthos is a system. It is a system of bands, brackets, buccal tubes and arch forms that, taken as a whole, is radically advanced from any other preadjusted system. Current preadjusted systems, including the one I used previously, are good appliances that have brought marked increases in orthodontic efficiencies. But there is a better way today, and I would like to show you how Orthos helped me meet and surpass my treatment and profitability goals.
Orthos Solutions to Commonly Encountered Orthodontic Problems

You've possibly seen Ormco's technical report that outlines how Orthos makes it possible to minimize many of the most common clinical problems experienced in day-to-day practice. Each of us probably has a somewhat different opinion as to the severity of each problem and, like me, you've experienced many of them in your practice. I'll draw on the technical report's definition of the problems and Orthos solutions (I'll show them in italics) and compare them with my clinical experiences.

Problem 1: First-order discrepancies and placement difficulties with lower anterior brackets. Conventional lower anterior bracket labiolingual profile makes placement difficult in crowded cases. First-order bends mesial to the lower cuspid brackets are frequently required. Other problems exist with occlusal interferences and hygiene. This was definitely a problem for me and, apparently, with virtually all orthodontists using non-Orthos appliances. Compare the much greater in-out dimension of a non-Orthos lower incisor bracket with the Orthos appliance (Figure 6). Bracket placement was always a problem when lower incisors were rotated (Figure 7). In deep-bite cases, the thicker brackets caused occlusal interferences with the upper incisors, sometimes resulting in debonded brackets and other times in notched incisal edges of the upper incisors. And, as stated, the thicker brackets frequently produced an incisal edge discrepancy between the lower lateral and cuspid that required an offset bend mesial to the cuspid (Figure 8).

Solution 1: Compensation is cut into the slot of lower cuspid brackets and the shape of the archwire is adjusted to sweep close to the tooth surface, allowing a dramatic reduction in the profile of lower incisor brackets. This solution has been a godsend to my practice. Bonding difficulties caused by rotated teeth have been reduced as have notched incisors and bond failures with lower incisor brackets. The compensation in the slot of the lower cuspid bracket (Figure 9) has

eliminated the need for the in-out bends in most cases. Note that the archwire slot on the mesial wing of the bracket is cut deeper into the wing than the slot depth on the distal wing. Figure 10 compares the Orthos prescription on the left (patient's right) with a typical preadjusted appliance on the right. Notice that the Orthos archwire exits the mesial of the lower cuspid very close to the facial surface of the lower incisors. This is why the Orthos lower incisor brackets can be thinner labioliugally and minimize the problems described. Notice in Figures 11-12 how well the incisal edges of the cuspids “flow” into the incisal edges of the lower incisors.

Orthos arch forms are designed to sweep close to the facial surface, so to take advantage of the Orthos System, it's important to use the scientifically

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matched Orthos archwires in conjunction with Orthos brackets. Proper placement of the cuspid bracket is also essential to properly compensate for the first-order discrepancies. In my seminars, I’ve encountered colleagues who were still frequently placing offset bends mesial to the lower cusps, because they were positioning lower cuspid brackets at the geometric center of the teeth. Placement of the lower cuspid bracket over the height of contour of the facial surface is the proper position for it, approximately 1 mm mesial to the geometric center (Figure 13).

Problem 2: Uprighting lingually inclined mandibular posterior segments. Most preadjusted appliance torque values were designed for placement at the FA point. When a bracket is placed at this location, however, the opposing dentition can interfere; when placed out of occlusion (at the typical clinical location), the result can be lingual inclination of the lower posterior segment. “Dumping” of lower posterior segments had been a problem for most orthodontists prior to Orthos. Figure 14 demonstrates the occlusal interference problems with the use of the FA point, equidistant from the occlusal and gingival borders. In practice, however, most appliances are placed gingivally to this point to avoid interferences and bond failures. This altered position, which places the bracket slot more gingivally on the curved buccal surface of the lower posteriors, results in a change in the torque value of the bracket. The orthodontist has changed the torque prescription without intending to do so! The net effect is an increase in lingual crown torque on the tooth (Figure 15). Lingual crown torque is being placed on a tooth that may need buccal uprighting.

Solution 2: The Orthos posterior appliance design was based on “typical” placement rather than placement at the FA point. Torque values were reduced in the lower bicusps and molars to avoid dumping them. This solution has been an obvious but, somehow, overlooked cure for the very common posterior dumping of the past. For example, lower 1st molar torques have been reduced to 10° from the typical 25°. The new prescription has satisfied the requirements for the “Best Fit Buccal Cusp Equation.” Remember that the BF BCE determines the best position of the mandibular teeth in the Mantroff. If there is excessive lingual crown torque on the lower posteriors, the buccal cusps of these teeth are moved lingually and the mandibular arch is constricted compared with the BF BCE. I should caution you that positioning Orthos buccal tubes at the FA point would likely leave your molars too upright.

Problem 3: Consistency achieving proper root alignment in lower anterior region. If one looks at the initial panoramic radiograph of the typical orthodontic patient, significant convergence of the lower incisor and cuspid roots is readily apparent. That is, there is a significant mesial root inclination (Figure 16). Most preadjusted appliance systems have “universal” lower incisor brackets with zero degrees of distal root tip (Figure 17), making root paralleling difficult. The orthodontist is forced to overcome the limitations of the appliance by “tweaking” the brackets during bonding to try to place 2° to 4° of distal root tip into the placement of the bracket. I am 44 years old – I need glasses with extra magnification just to see the brackets! There is no way I can see 2° to 4°. If it can be built in, that is a huge plus.

Solution 3: Progressive distal root tip is built into all lower anterior brackets to achieve improved uniformity in root spacing. Orthos overcomes the problem by placing progressive distal root tip into the lower incisor and cuspid brackets (Figures 18-20). There are no universal brackets for the Orthos lower anteriors, or for any other tooth for that matter. This does not pose an inventory problem since it requires no more inventory than would a universal system. If you need four lower incisor brackets, that’s all you need to have in stock. They’re just tooth specific.

Problem 4: Difficulty achieving level marginal ridge contacts and proper root alignment in mandibular posterior segments. Many preadjusted appliance systems offer universal brackets (0° angulation) for both right and left lower 1st and 2nd bicuspids. This leads to the distal marginal ridges of these teeth being depressed relative to their ideal positions and also causes root paralleling problems (Figure 21).

Solution 4: Lower bicuspid brackets are designed with distal root tip to achieve
balanced marginal ridge heights and proper root alignment. Orthos lower bicuspids are tooth specific, not universal, with 3° distal root tip to properly relate to 6° distal root tip on cuspids and 0° on lower 1st molar tubes (Figure 22).

Problem 5: Rotating upper 1st molars adequately to facilitate both a Class I relationship and ideal interdigitation with lower 1st molars. Rotating upper 1st molars adequately to produce a Class I occlusion has been a problem with some current preadjusted appliance systems. We all know that in many cases the molar relationship appears to be either Class II or end-on Class II. Sometimes this is not due to a skeletal problem, but rather to a significant mesial rotation of the upper 1st molar. The mesiobuccal cusp appears Class II because the tooth is rotated mesially. There is increased overjet because the maxillary dentition is pushed forward in the arch by the excess space taken up by the molar (Figure 23).

Solution 5: Orthos upper molars are rotated to occupy the least amount of arch space. At the same time, lower molars are positioned with respect to generally accepted occlusal landmarks, resulting in improved molar interdigitation.Ormco has determined that 15° distal offset on upper 1st and 2nd molar tubes causes the molars to occupy the least amount of arch space. Lower 1st molar tubes with 0° offset and lower 2nds with 5° interdigitate lower 1st and 2nd molars properly with the uppers. Figure 24 shows how the Orthos distal offset adequately rotates the upper molars to occupy the least amount of space in the arch.

continued on following page
Problem 6: Current appliances often finish with a height discrepancy between the distal marginal ridges of the upper 2nd bicuspids and mesial marginal ridges of the lower 1st molars. Figure 25 shows that if there is a discrepancy between marginal ridges in the maxillary arch, the occlusion with the lower arch will suffer. The maxillary marginal ridges are the centric stops for the buccal cusps of the lowers. This problem is another result of using universal brackets on bicuspids.

Solution 6: Correct distal root tip is incorporated into upper 2nd bicuspid brackets. Proper distal tip places the distal marginal ridge of the 2nd bicuspid at the same height as the mesial marginal ridge of the 1st molar. A proper centric stop is provided for the mesiobuccal cusp of the lower 1st molar and better root paralleling is provided for the roots of the upper bicuspids (Figure 26).

Problem 7: First-order bends consistently required to step in upper 2nd bicuspids to align maxillary central grooves. Even though upper 2nd bicuspids are smaller than upper 1sts, many current appliances provide universal upper bicuspid brackets. Consequently, archwire engagement causes the upper 2nd to move buccally (Figure 27). The central grooves of the upper posteriors do not align, requiring in-out bends to step in the upper 2nd (Figure 28). Remember that the lower buccal cusps must align buccolingually with the central grooves of the upper posteriors to produce functional centric stops. If the upper central grooves do not align with each other, they will not occlude properly with the buccal cusps of the lower posteriors and a functional shift will be present.

Solution 7: The Orthos System incorporates a thicker upper 2nd bicuspid bracket that better synchronizes with the upper 1st bicuspid and 1st molar. This automatic step-in effect results in a better alignment of the central grooves of the bicuspids and molar (Figure 29). The use of tooth-specific brackets in the Orthos System helps eliminate the presence of a functional shift. This is an excellent example of how the Orthos System "puts it all together." Orthos lower brackets satisfy the demands of the BFCE, and the upper posterior brackets align the central grooves of the upper posteriors. The result is a superior occlusion.

Problem 8: Upper posterior segments can compromise cuspid rise occlusion as a result of balancing interferences (Figure 32). Moderate buccal crown torque on maxillary posterior segments prevents lingual cusps from dangling, which particularly accommodates current nonextraction mechanics (Figure 33). Number 8 has not been a problem for me with Orthos.
or my previous appliances. I would appreciate hearing from anyone who has experienced and dealt with this problem. Maybe I have not looked back there closely enough!

Problem 9: Difficulty achieving coordination of upper and lower arches, especially during finishing. This is a common problem with many preadjusted appliance systems and is due to a number of factors. First, there are several preadjusted appliances that actually lack an associated arch form. The orthodontist has to choose which one to use. Most currently popular arch forms spring from three sources:

- Some orthodontic guru's idea of what is correct
- A catenary curve
- Shape of the end of an egg (trifocal ellipse)

Solution 9: Orthos arch forms and brackets are computer-derived from skeletal analysis and are integrally designed to coordinate the dental arches. Anthropological studies of human skeletal anatomy were the source of the data from which Orthos arch forms were derived. The lower arch form positions the mandibular teeth in the center of the alveolar bone of the mandible, the Mantroff. Mandibular buccal cusps are positioned to form a smooth arch that truly reflects the size and shape of the mandible. The upper arch form then occludes the maxillary teeth to the mandibular cusp arch form (Figures 34-35). There are two upper and two lower arch forms in order to make the most precise "average arch form" somewhat patient specific, to give better coverage to the left and right of the top of the bell curve into which more dentitions fall (Figure 36).

It is this integration of computer-derived arch form and bracket design that optimizes clinical finishing. Orthos is unchallenged as a finishing appliance. It separates itself from the crowd in the final stages of treatment. Here is where all the slight to moderate differences built into Orthos deliver the best clinical finishing available. It is during the final weeks of treatment, when the patient is growing weary of braces, that many appliances demand a high degree of patient cooperation in the wearing of finishing elastics. This is where the case may be finished wonderfully or just okay, and Orthos significantly reduces the level of patient cooperation required by other appliances. A comment heard time and time again from long-time Orthos users is "the teeth just fit together better."

Problem 10: Common upper and lower 2nd bicuspid bond failures resulting in increased rebonds or frequent 2nd bicuspid banding. The Journal of Clinical Orthodontics practice survey reveals that most orthodontists report bond failure rates of around 5 percent. However, it has been found that when orthodontists actually track and record their bond failure rate over a three-month period, the average is close to 15 percent. This amount will seriously affect profitability and efficiency. And, as one would expect, upper
and lower bicuspids are the teeth with the highest failure rates.

Solution 10: Optimesh®XRT coating increases bond strength by over 35 percent, and gingivally-offset bicuspids with the pad extended occlusally increase the bond area. All Orthos bicuspid brackets are available with the enlarged bonding pad that extends occlusally to increase the bond area. The bracket slot is at the recommended height but placed on the gingival section of the occlusally extended pad. Figure 37 shows a conventional bicuspud bracket on the left and an Orthos bicuspud bracket on the right. Notice the large increase in bonding pad surface. Figure 38 shows an electron microscope view of Ormco’s Optimesh®XRT coating, an improved version of Optimesh that increases the surface area of the mesh for a marked increase in mechanical retention. Figure 39 compares a competitor’s bonding pad and mesh on the left with an Orthos bonding pad with OptimeshXRT on the right. The visual display speaks for itself.

**Conclusion**

Space limitations don’t permit a detailed explanation of my archwire sequencing with the Orthos appliance. There is no one correct sequence of archwires that must be used for Orthos to be effective (just make sure you use the Orthos arch form). I did want to point out some key considerations and then show a quite revealing pre-Orthos and Orthos practice efficiency comparison. With both appliances, I took advantage of variable modulus mechanics, enjoying extended intervals between patient visits and moving more rapidly to finishing. My archwire sequencing became progressively more sophisticated and intervals between patient visits became longer as I more fully implemented the Orthos System. I added Copper Ni-Ti, and I would encourage leaving the initial .017 x .025 Copper Ni-Ti wire in place for up to a year or more. This has greatly facilitated treating nonextraction cases with only two archwires per arch. But I feel that most of the improvement was due to the Orthos appliance itself: some because the Orthos appliance provided for easier and earlier engagement of rectangular wires; most because of the Orthos solutions to the inherent design deficiencies of previous preadjusted appliances.

How do we, as orthodontists, know whether something we implement into our practice really works or whether we just made a change of no particular value? I conducted an audit of 25 sequentially treated cases finished prior to converting to Orthos and on my last 25 Orthos cases. Both extraction and nonextraction cases were included (Figure 40).

The results of the audit speak for themselves. The case presented starting on the facing page also demonstrates the efficiency and effectiveness of the Orthos System. Orthos has made a dramatic impact on my practice. I have made big improvements in measuring up to my mission statement and in meeting my practice and treatment goals. My patients are benefiting from a higher level of care and from decreased demands on their time and patience. I encourage any reader to take full advantage of the research and effort that went into developing this magnificent leap forward in orthodontic knowledge and technique.

<table>
<thead>
<tr>
<th>Treatment Category</th>
<th>Pre-Orthos</th>
<th>Orthos</th>
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<tbody>
<tr>
<td>1. Average treatment time</td>
<td>25 months</td>
<td>22 months</td>
</tr>
<tr>
<td>2. Average # appointments to complete treatment</td>
<td>22 appts.</td>
<td>16 appts.</td>
</tr>
<tr>
<td>3. Number of archwires used in maxillary arch</td>
<td>6 archwires</td>
<td>4 archwires</td>
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<tr>
<td>4. Number of archwires used in mandibular arch</td>
<td>5 archwires</td>
<td>3 archwires</td>
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<tr>
<td>5. Average # of emergency appointments due to bond failures</td>
<td>3.5 appts.</td>
<td>1.5 appts.</td>
</tr>
<tr>
<td>6. Average appointment interval</td>
<td>5 weeks</td>
<td>8 weeks</td>
</tr>
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</table>
**Orthos Case Presentation** Patient J.H., age 13 years, 5 months.

### Diagnosis

**Skeletal**
- Class II skeletal growth pattern
- Retrognathic mandible

**Dental**
- Moderate mandibular crowding
- Deep curve of Spee
- Vertical overbite = 6 mm
- Maxillary cusps erupting high and labially
- Over-retained primary cusps
- Maxillary left 2nd bicuspid rotated 90°
- Mandibular midline shifted left 3 mm

### Treatment Plan

1. Extract maxillary primary cusps
2. Nonextraction therapy using Orthos
3. Rapid palatal expander
4. Lip bumper
5. Anticipated treatment time = 24 months

### Treatment Summary

- 16 appointments
- 24 months
- RPE alone – 12 weeks
- Lip bumper – 21 weeks
- Maxillary appliances – 97 weeks
- Mandibular appliances – 77 weeks

### Archwire Sequences

**Maxillary Arch**
- .017 x .025 35°C Copper Ni-Ti – 10 appointments, 75 weeks
- .017 x .025 S.S. – 4 appointments, 22 weeks

**Mandibular Arch**
- .016 x .022 35°C Copper Ni-Ti – 6 appointments, 42 weeks
- .017 x .025 S.S. – 5 appointments, 35 weeks

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### Pretreatment

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continued on following page
Case in Progress

Appointment #3, week 12.
Bonded upper 5 to 5 with Orthos brackets. Placed an .017 x .025 35°C Copper Ni-Ti upper archwire. Seated lip bumper in previously bonded lower 1st molars.

Appointment #6, week 32.
Removed RPE and discontinued lip bumper therapy. Bonded and banded lower arch and placed an .016 x .022 35°C Copper Ni-Ti archwire. Placed Power Chains 6 to 6 in upper arch.

Appointment #14, week 98.
An .017 x .025 S.S. upper archwire had been placed at the previous appointment. Placed an .017 x .025 S.S. lower archwire.

Dr. Andrews

continued from page 17

Even though some orthodontists and most orthodontic companies have put their name on adaptations of my original appliance, none to this day have the comprehensive clinical solution represented by my appliance system.

Beginning in 1980, I decided to devote my energies to looking for treatment goals for arch shape and length: AP, BL, SI jaw positions and pogonion prominence that were as objective as the Six Keys to Normal Occlusion © (now renamed the Six Keys to Optimal Occlusion ©). By 1990 I had found them. They are called the Six Elements of Orofacial Harmony ©.

I have just agreed to act as a consultant forOrmco/“A” Company and to teach the Andrews® Straight-Wire Appliance as a system. Now that I am teaching about the Six Elements of Orofacial Harmony, I have a perfect opportunity to show and teach the Straight-Wire Appliance the way it was originally designed to be used and the way I have used it since it was first available in the 1970s.
You can now see and hear on demand aspects of clinical and practice management seminars by leading lecturers via our internet website, www.ormco.com. The Face as a Determinant of Treatment Choice by Dr. David M. Sarver is the first presentation of Seminars Online and will soon be followed by others.

Free and available anywhere, Seminars Online supplements our continuing education seminars, Clinical Impressions Live! (www.ormco.com/seminars/)

It uses the advanced RealMedia G2 technology, synchronizing good quality audio with slide images. To view the presentations from our website, simply click on the Seminars Online icon and follow the instructions for loading the free G2 software. Through it you can pause, fast forward or rewind the presentation, controlling it much as you would a VCR. On the Seminar Online site are links to Clinical Impressions Live! where you can check the schedule of upcoming seminars and register online.
Posttreatment  
(eight weeks after debanding).

The technology of Orthos...and its effect upon practice efficiency

Have you taken full advantage of the technological advances in orthodontic appliances? According to the most recent JCO survey, the majority of practitioners still use a four-week appointment interval (the same result reported in the survey ten years earlier). With overhead continuing to rise, the efficiency of treatment mechanics can have a profound impact on the bottom line, not to mention other positive effects like happy parents and patients.

The practices audited represent two additional doctors who have embraced the new technology of Orthos® and titanium archwires. The results: increased appointment intervals, reduced archwire changes and shortened treatment times without compromising final results.

Orthos** can be the solution to your efficiency and profitability problems. For additional information or to order, see page H of the Center Section or contact your Ormco/“A” Company representative or distributor.

* Records of audits on file at Ormco.
** Products identified as “Orthos” are distributed in Europe as “Ortho-CIS.”
Dr. Damon

continued from page 9

life is time. I think most practitioners will agree that in the past 15 to 20 years, the patients and families who come into our offices are stretched for time to manage their daily schedules. How many times are we asked, “How long will this appointment take?” and “When do I get my braces off?” and “How often will I have to come in?” Time has become a major factor in swaying a patient’s decision about treatment one way or another.

Second is the huge issue of comfort. “How much will my braces hurt?” is one of the first and most important questions patients ask. I feel strongly that high-technology archwires and low-friction brackets have had a major impact on both treatment times and patient comfort. We are seeing a significant reduction in treatment times for a large segment of our practice, allowing us more time to focus on those cases that take more time, regardless of the treatment system used.

It is exciting when a new technology can have a positive influence on our patients, on our clinical staff and on us. Many clinicians using the new-generation orthodontics are seeing a major impact on the number of patients seeking orthodontic treatment, particularly non-dentist referred adult patients. The challenge for all of us is to let research and clinical observations guide the direction of this new technology. After spending many hours carefully evaluating thousands of slides, X-rays and final treatment results, I firmly believe that passive self-ligation will play a significant role in the future of clinical orthodontics.

References

Dr. Awbrey

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Finishing

Because I am too impatient to wait for the occlusion to settle with the Bite Fixer, I place finishing elastics to detail the final occlusion (Figure 15). I usually allow approximately 6-8 months for finishing. While other doctors may recommend 12 months, I feel spending additional time in the aligning and leveling phases and removing the majority of dental compensations dramatically decreases the amount of time spent finishing and, consequently, overall treatment time.

Conclusion

While the Herbst has proven to be effective for some doctors, for me there was just too much time spent fitting crowns, waiting on my lab, cementing crowns, removing the appliance for repairs, refitting and recementing bands for finishing and, to top it all, a highly uncomfortable experience for the patient. In the years I have been using a fixed spring appliance, I have never been more pleased with the results I am seeing. The Bite Fixer has reduced treatment times by increasing reliability and minimizing breakage. For me, the Bite Fixer is the noncompliance appliance of choice that compares favorably with the wide choice of alternatives.

References
### Lecture/Course Schedule at a Glance

<table>
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<th>Location</th>
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<td>6/3-4</td>
<td>Wick Alexander</td>
<td>La Stezia, Italy</td>
<td>Alex. Disc. Study Club of Italy; Dr. Caliari 39-444-32-22-91; Ortho Tx of Deep-Bite Malocclusions</td>
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<td>6/4-5</td>
<td>K. Takemoto/G. Scuzzo</td>
<td>Hamburg, Germany</td>
<td>Ormco Europe; Michéle 31-3-3453-6154; Lingual Ortho Typodont Course*</td>
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<td>6/5</td>
<td>Richard Boyd</td>
<td>Ann Arbor, MI</td>
<td>15th Annual Jarabak Lecture; Dr. McNamara (734) 763-1565; Practice Mgmt. for New Millenium</td>
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<td>6/11-12</td>
<td>Didier Fillion</td>
<td>Berlin, Germany</td>
<td>Dr. Neumann 49 30 8445 6121; Basic Lingual Ortho*</td>
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<td>6/18-19</td>
<td>Uta Richter</td>
<td>Wurzburg, Ger.</td>
<td>Dr. Richter; H. Sponsel 49-931-50095; Herbst Course</td>
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<td>6/18-20</td>
<td>B. Durand/M. Gentet</td>
<td>Ste Marie, Mer, Fr.</td>
<td>AOSM; Josiane 33-1-4895-1617; “The Temporomandibular Joint”</td>
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<td>Luis Bates</td>
<td>San Jose, C. Rica</td>
<td>Dr. Batres 50-7-260-4660; Alexander Discipline Advanced</td>
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<td>6/21-23</td>
<td>Didier Fillion</td>
<td>Paris, France</td>
<td>Dr. Fillion 31-1-4755-1833; 2nd Session Lingual Ortho, One-Year Program*</td>
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<td>6/24-25</td>
<td>Duane Grummons</td>
<td>Buenos Aires, Arg.</td>
<td>Dr. Grummons; Tracie (509) 328-5744; Orthodontics for the TMD Patient</td>
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<td>S. Righelli/M. Swartz</td>
<td>Toronto, Canada</td>
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<td>6/25-26</td>
<td>Terry Dischinger</td>
<td>Lake Oswego, OR</td>
<td>Dr. Dischinger; Carrie (503) 635-4439; In-Office Comprehensive Hands-On Herbst Training*</td>
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<td>Williamsburg, VA</td>
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<td>Tokyo, Japan</td>
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<td>Nara, Japan</td>
<td>Ormco Japan; Roy Kishi 81-33945-0065; ADSCJ Meeting – Ext. vs. Nonext./Is Mounting Necessary?</td>
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<td>7/9-10</td>
<td>R. Bennett/M. Swartz</td>
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<td>Ormco/A Co.; Meredith (800) 854-1741, Ext. 7573; Orthos System &amp; More/Titanium Archwires</td>
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<td>Duane Grummons</td>
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<td>Ormco/A Co.; Tracie (509) 328-5744; In-Office Nonextraction, Efficient Bioprogressive Innovations*</td>
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<td>7/19-23</td>
<td>Nasib Balut</td>
<td>Puerto Vallarta, Mex.</td>
<td>Ormco de Mexico; Irene 525-264-2125; Hands-On Ortho Course*</td>
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<td>7/30</td>
<td>D. Damon/T. Pitts</td>
<td>Park City, UT</td>
<td>Ormco/A Co.; Meredith (800) 854-1741, Ext. 7573; Back to the Future: Passive Self-Ligating System</td>
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<td>7/30-31</td>
<td>Michael Swartz</td>
<td>Philadelphia, PA</td>
<td>Ormco/A Co.; Meredith (800) 854-1741, Ext. 7573; Titanium Archwires/Bonding – There Ain’t No Magic</td>
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<td>8/13-14</td>
<td>R. Bennett/M. Swartz</td>
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<td>Larry &amp; Will Andrews</td>
<td>Curitiba, Brazil</td>
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<td>J. Mayes/P. Allen-Noble</td>
<td>Cincinnati, OH</td>
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<td>Jim Hilgers</td>
<td>Kruger Park, S. Afr.</td>
<td>SASO Conference; Dr. Scherman 27-12-348-4227; Hyperefficient Orthodontics</td>
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<td>Arlington, TX</td>
<td>Ormco/A Co.; Brenda (817) 275-3233; Principles of the Alexander Discipline*</td>
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*Typodonts and/or Participation

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