With the steady, and seemingly inexorable, march from ligation to self-ligation in the clinical practice of orthodontics, orthodontists are mastering a new body of knowledge to harness the many advantages that self-ligation brings to our practices.

The management of the appliance is not the only thing that is different; we also find changes in the management of the patient, and the logistics of the practice. Having treated patients for almost 2-1/2 years with the SmartClip™ Appliance System, I am finding that this self-ligation technology, and the thought process that accompanies it, have an impact on our diagnosis and treatment planning, chair time, archwire sequencing, and overall clinical efficiency.

We are starting to see a substantial improvement in treatment efficiency, with a substantial savings in treatment time for us, and a reduction in inconvenience to patients. It is already evident that oral hygiene management is easier with self-ligated appliances, given the absence of elastic ligatures, and the cumulative effects of all these advances made a powerful and persuasive argument in favor of the SmartClip system.

In the process of treating my patients, and increasing my understanding of the differences in technique that come into play, I have begun to accumulate some “Clinical Pearls” (Do’s and Don’ts) that have proved to be quite valuable. I would like to share some of these with you, and will emphasize the following in this article:

- Bracket Placement
- Indirect Bonding
- Archwire Sequencing
- The Sondhi .012 Super Duper Contact Opening Archwire
- Rotation Control
- Finishing Archwires
- Modifying Your Systems
- Variable Prescriptions
- Clarity™ SL Self-Ligating Appliances

### Bracket Placement

In trying to find instruments that would permit proper placement of the bracket on the tooth, I found that the instruments that I had traditionally utilized with ligated brackets were not particularly useful. In a ligated system, of course, the instrument can be inserted completely into the bracket slot. This is obviously undesirable with the SmartClip bracket because we would not want to engage the clip. That said, it remained necessary to engage enough of the bracket slot to permit proper mesiodistal and vertical positioning of the bracket.

Having tried many different instruments, the one that I have found to be the most effective is an instrument called a Tarno. It is probably referred to by other names, and is basically a plastic filling instrument used in operative dentistry (Figures 1A and B). Figures 1C, D and E demonstrate, from different perspectives, the manner in which this instrument engages the bracket slot for adequate control, without inserting itself into the clip. If you have any interest in this, the instrument is called a Plastic Filling Instrument PFI-3, and you may obtain it by contacting Paul Cotter at pcotter@indy.rr.com, or (317) 719-9410. The instrument is made by Peerless International, and I obtain it through Mr. Cotter. A word of caution. Other plastic filling instruments of similar appearance are made by the same company but the blade thickness is either too much or too little. PFI-3 is the one that fits the bracket the best.
Indirect Bonding

We have been indirect bonding the SmartClip brackets for the past 2-1/2 years, and the existing indirect bonding technique works well. The only change that we have had to make emanated from our concern that the Nitinol clip may prove difficult to tease out of the Bioplast inner tray. For that reason, we are now recommending that a small drop of Alcote be placed on the bracket (Figure 2) prior to the formation of the tray. The Alcote dries on the clip wings, and tray removal has proved to be quite simple.

Archwire Sequencing

There is a general tendency, when treating with ligated edgewise appliances, to progress to stiffer and larger archwires as rapidly as possible. Some of this is driven by a desire to obtain 3rd order control earlier in the process, and sometimes to facilitate the use of inter-arch elastics. While those are all appropriate and laudable reasons, the fact remains that we must continue to remember that it actually takes very little force to move a tooth. Consequently, the temptation to progress to stiffer and larger archwires, when treating with the SmartClip system, should be resisted. There are two profound reasons for this.

It behooves us to remember that any self-ligating bracket, and certainly this is true of the SmartClip bracket, is in essence a “binary” bracket. I use that term because there really is no such thing as partial engagement of an archwire into a self-ligating bracket slot. The archwire is either in or out. For that reason, if one proceeds to larger or stiffer archwires early in the process, while some of the teeth are still slightly displaced, engaging and disengaging the archwire simply requires more work, and is certainly not pleasant for the patient. All such movements should be accomplished with lighter archwires, and we recommend that you avoid going to larger steel archwires until preliminary alignment has been achieved. Further, it is necessary to work out all rotations prior to placing a rectangular archwire.

Putting labio-lingual steps in a rectangular steel archwire, and then trying to engage it into the SmartClip bracket, is not recommended. In Figure 3, it is easy to see that the maxillary lateral incisors were not completely de-rotated. Proceeding from a round to rectangular wire was, therefore, inadvisable. Indeed, a close look reveals that the archwire is not completely seated in the distal wing, and the rotation would remain uncorrected. This is not a problem with the bracket, it is a problem with the way it was used. The rotation corrections should have been completed with a round archwire, an .016 round in an .018 x .025 slot, or .020 round in an .022 x .028 slot, before proceeding to a rectangular archwire.

This brings us to another fallacy, and potential source for difficulty. The bracket clearly has the advantage of being ligated on an as-needed basis. That is certainly one of the features that make it stand out from other competing self-ligating brackets. However, it is inadvisable to try and flex the .025 dimension of a steel archwire into a tooth that is still slightly rotated. In fact, practitioners may convince themselves that the rotation may correct because they ligated that wing, but a closer look (Figure 4) reveals that the archwire is still not completely seated in the clip.

My point here is not that selective use of ligatures is inadvisable. In fact, I have described the ability to ligate on an as-needed basis as equivalent to having a turbo-charger in your car’s engine. When you are simply coasting down the highway, the turbo-charger is dormant, and unnecessary. However, when you need to step on the gas to pass someone, the turbo-charger will kick in on an as-needed basis. That is not a bad way to view how ligatures come into play, on a selective basis, with the SmartClip bracket.
My point in drawing your attention to this is simply to re-emphasize the “binary” nature of the bracket, and to emphasize that trying to force an archwire that the bracket is not yet ready for is likely to be counter-productive. The problem in Figure 4 is not with the bracket or with the ligation – the archwire selected is simply too stiff. The rule to remember here is that if the wire is difficult to insert, it is probably too big or too heavy a wire. That is why I have found the .014 x .025 Nitinol archwire to be a terrific transitional archwire from the round to the rectangular series with the SmartClip system (Figure 5).

The Sondhi .012 Super Duper Contact Opening Archwire!

I have previously pointed out that rotation control with the SmartClip appliance system requires a different thought process than does rotation control with a ligated appliance. To reiterate, that is simply because the archwire will not be pushed into the base of the slot. Figure 6 demonstrates why going to an .016 x .025 Nitinol archwire was inadvisable with the mandibular left lateral incisor still rotated, with its mesial contact point overlapping the distal surface of the mandibular left central incisor.

We have found it extremely effective to use a simple .012 steel archwire with a vertical loop to literally “pop” open the contacts in order to facilitate rotation corrections. The archwire is demonstrated in Figure 7A-E, and the process for constructing it is as follows. We take a simple .012 preformed steel archwire, and lay it into the bracket slots. The archwire is then marked on the mesial of the molar tubes, and a simple vertical loop approximately 4mm long is then bent with bird beak pliers.

Depending on the amount of activation desired, the loop can be anywhere between 1 and 2mm wide. When this archwire is then inserted back into the individual SmartClip brackets, the vertical loop will be lightly compressed. Yes, I know, the force level would be astonishingly low with a simple vertical loop in an .012 steel archwire, and this is a good time to remind everyone of two things. First, we have come to recognize that extremely light forces are very effective in causing tooth movement. Second, please keep in mind that there is virtually no friction in the system, and that the .012 archwire will slide with great ease through the bracket slots to effect the opening of the contact.

After that, one can go into an .016 steel or .014 x .025 Nitinol archwire, and easily achieve the rotation correction. I consider this archwire invaluable in managing treatment with the SmartClip appliance.

Rotation Control

Rotational deficiencies are inherent in any self-ligating bracket. This is because the process of ligation literally slams the archwire into the base of the slot, and there is no such forcible seating of the archwire in a self-ligating bracket. The very process of engaging and disengaging the self-ligating mechanism requires a certain clearance between the wire and the self-ligating mechanism. Brackets from different manufacturers have tolerances that range from .027 to .030 inches, so even an archwire with a depth of .025 will allow some rotational “slop”. The SmartClip bracket has a depth of .0275 on all brackets except the mandibular incisors, where the depth is milled to a tighter tolerance of .027 for better rotation control.

Slight off-center positioning of SmartClip brackets is helpful in rotational control. In effect, if a tooth is rotated, we do not recommend placing the bracket precisely the way you would with a ligated bracket. The bracket should be placed another .5mm toward the rotation (Figure 8). This will automatically overcome the problem of rotation control. Indeed, placing brackets on rotated teeth precisely the way you would in a ligated system is one of the reasons behind the claim from some practitioners that rotation control with self-ligation is poor. If it is not possible to bias the placement of the bracket towards the side of the
rotation, usually because of the positions of overlapping teeth, then care must be taken to reposition those brackets as early in treatment as possible. I also find that it is beneficial to accomplish any planned interproximal reshaping of the teeth earlier in the treatment process.

It is advisable to resist the temptation to engage a light archwire into every bracket slot, no matter how rotated the tooth. It is substantially better to engage the archwires selectively for severe rotations, and to engage the second clip after some preliminary rotation has been achieved. Forcing the archwire will increase the risk of plastic deformation of the archwire, and thereby inhibit the rotation correction from occurring. If, for example, the distal wing of a bracket engages relatively easily, the mesial wing should either be left alone, or lightly tied towards the archwire with a ligature. This, of course, is easily accomplished with the SmartClip bracket because it is basically a twin edgewise bracket, and either one of the wings can be ligated selectively.

**Finishing Archwires**

It has long been understood, and well accepted, that accurate bracket placement is of paramount importance in realizing the efficiency of a pre-adjusted appliance. If you thought that was true with ligated appliances, consider it a cardinal rule in treatment with the SmartClip system.

I have already mentioned that bracket repositioning should be done as early as feasible. Once you are in your finishing rectangular steel archwires, it is undesirable to place steps and offsets in the archwire, and to then try and re-engage it through the clip. The insertion process will simply not be easy with rectangular steel wires. For that reason, as well as a desire to use lighter forces, I now find myself doing most of my finishing in Beta III Titanium archwires. In the .018 x .025 slot, an .016 x .025 Beta III Titanium finishing wire gives excellent control, and allows for minor adjustments without making the insertion and removal process difficult. In an .022 x .028 slot, the .019 x .025 Beta III Titanium wire is equally user friendly (Figure 9). I have used inter-arch elastics with Beta III Titanium archwires, and not experienced any loss of control, or untoward consequences. Some finishing elastics are extremely effective in light archwires during the final few weeks of treatment.

**Modify Your Systems**

It is increasingly evident that the efficiency generated with self-ligating appliances allows us to sequence treatment more efficiently, and also decreases the chair time once the initial learning curve is over. As interesting as this technical innovation is, I am increasingly convinced that doctors sometimes are unable to embrace such new technologies, even though they may provide quantum leaps in efficiency. This is due to the fact that the increase in clinical efficiency upsets the equilibrium in our offices. We are, in effect, unable to modify our management systems to take advantage of the enhanced efficiency, partly because it involves having to change the behavior of entrenched staff members.

For example, I have encountered doctors and business office staff who are afraid that patients will demand a reduction in fees if treatment is concluded earlier, or more efficiently. I find such reasoning to be quite peculiar. I really can’t remember the last time that an airline flight arrived ahead of schedule, and the passengers demanded some money back because, obviously, the airline used less jet fuel! Indeed, the captain will generally come on the PA system and brag about having arrived ahead of time, and the passengers uniformly appreciate that. The hang-ups about this, my fellow orthodontists, do not come from the patients – they come from us. We have to be prepared to implement our own paradigm shift, and the patients will be entirely happy to have their treatment completed in a more efficacious manner.

**Variable Prescriptions**

For well over the last 3 decades, following the incorporation of pre-adjusted appliances under the tutelage of Dr. Andrews, different prescriptions have been developed and promoted. These prescriptions have been based on a number of factors, not the least of which is the practitioner’s philosophy of occlusion, the subjective assessment of aesthetic outcomes, and sometimes the functional elements of the temporomandibular joints as they relate to occlusal function.

Regardless of the differences between the prescriptions and schools of thought, and the differences are occasionally profound, there has always been one central theme. The prescription was always the prescription, to be used on every patient, be it a Class II Division 1 malocclusion, a Class III malocclusion, a skeletal openbite, or a simple Class I non-extraction case. Given our understanding, and the technology available at the time, that made perfect sense. We must, however, now embrace the understanding that there are several factors that affect the finished position of
the tooth, not the least of which is the starting position of
the tooth unless, of course, a full-sized finishing archwire is
used. I believe it is fair for me to say that the overwhelming
majority of orthodontic practitioners no longer use full-
sized finishing archwires anyway, not to mention that the
insertion of a full-sized finishing archwire into a self-ligating
bracket would become close to impossible. Given all that, it
behooves us to consider that the day and age of Variable
Prescription Modules has arrived in orthodontics.

We have been working on this project for some time now, and
a simple illustration of the logic that I am proposing can be
demonstrated by contrasting the two types of incisor
alignments frequently encountered in Class II Division 2
malocclusions. Figure 10A demonstrates a Class II Division
2 malocclusion with the classic configuration of the maxillary
central and lateral incisors. Figure 10B demonstrates a
different presentation of the Class II Division 2 malocclusion,
with all four maxillary incisors inclined lingually.

In the second of these two scenarios, it is obvious that the
practitioner would probably want to use a lateral incisor
bracket with relatively high torque built into it, in order to
express the 3rd order control that would be needed. However,
in the previous Class II Division 2 presentation, with the
flared maxillary lateral incisors, a high torque bracket would
hardly be desirable. Indeed, in both instances, the practitioner
may choose a higher torque central incisor bracket, perhaps
with 22° of lingual root torque, but would certainly want to
use a lower torque lateral incisor bracket when the starting
position of the tooth had a significant labial inclination. It is
appropriate then, to question the logic of using the same
lateral incisor bracket each time, which is what all static
prescriptions have either demanded or required. By the same
token, the axial inclinations in the mandibular anterior
segment would obviously be somewhat different if the patient
started with a Class II Division 1 malocclusion and extremely
flared mandibular incisors, or a Class III malocclusion with
retroclined incisors that would need to be decompensated. In
that scenario as well, it would be desirable to have either
higher torque or lower torque brackets, given the specifics of
the correction desired by the clinician.

There are many different manifestations and examples that
can be cited, of course, but it becomes quickly apparent
that the majority of the differences would be in the anterior
segment. The finished positions of the maxillary and
mandibular molars do not really differ significantly when
we are in the finishing stages of a Class II or Class III
correction. For that reason, we have established the high
and the low ends of the expressed torque values that are
likely to be clinically effective, recognizing that the teeth
must, at all times, be contained within the cortical bone.

Figures 11A, B and C show the high, medium, and low
torque ends of the spectrum. Figure 12 shows the extremes
of labio-lingual root torque in the mandibular anterior
segment, keeping in mind the earlier admonition to stay
within the confines of the cortical bone.

This is, I must emphasize, a work in progress. Although it is
clear that such appliances are not fully developed or available
to the practitioner, I believe it is appropriate for our profession
to start embracing the concept of Variable Prescription
Modules for high, medium, and low torque cases. I have
previously written about atypical bracket placement for high
angle, standard, and low angle cases, and this will be a terrific
extension of that concept. Over the span of the next year or so,
we expect to complete our development and testing of the
different prescription modules, and I look forward to sharing
that data with you once our work is complete.

**Clarity™ SL Self-Ligating Appliances**

The latest addition to the SmartClip system comes in the
form of Clarity™ SL Self-Ligating Brackets. The Clarity™
Bracket has a long and distinguished record in orthodontic
practice now, and was innovative in its incorporation of a
metal slot into an aesthetic bracket, thereby amalgamating
two positive attributes that were important in orthodontic
practice. The Clarity SL bracket simply incorporates a third
attribute, in that the only significant disadvantage with
aesthetic brackets has been the need to use clear elastic
ligatures, which would invariably discolor over time. The
incorporation of self-ligating clips obviously eliminates
that disadvantage.
We are currently treating several patients with the Clarity SL brackets (Figures 13A and B), and have found no significant difference in wire insertion and removal when compared to the SmartClip brackets. As we finish these cases, of course, the bracket will be tested across the entire spectrum of orthodontic applications. I do, however, want to emphasize the added advantages we will realize when we couple an aesthetic self-ligating bracket like the Clarity SL bracket with the variable prescription modules I have outlined in a preceding paragraph. I will look forward to reporting on these cases in the near future.

Conclusions

As mentioned at the start of this article, the incorporation of self-ligating brackets required the mastering of a new body of knowledge. I have tried to share some of our “clinical pearls” with my colleagues, with the intent and hope that it will facilitate the use of the SmartClip system, and allow you and your patients to enjoy the remarkable efficiency that this technology brings to our practices.