Self-ligating brackets
A discussion of the pros, cons and specifics

By Dr Daniel Gub, Orthotown Editorial Director

With the rapid change in orthodontic delivery systems and appliances—hello, clear aligner therapy—some clinicians may feel like the days of brackets and wires are over, or seen to be completely regressed. But judging from the discussion I recently had with experienced dentist Dr Stuart Frost (pictured), that’s anything but the case. After a recent conversation about self-ligating brackets, I came away more enthusiastic than ever about the future of traditional appliances with modern technological advances. Included in the talk, the design and advantages of passive versus active self-ligating, the specific benefits to patient care, whether treatment times really become shorter, and patient comfort. As an early adopter of Damon technology and philosophy—and the author of The Artist Orthodontist: Creating an Artistic Smile is More Than Just Straightening Teeth—Frost is supremely qualified to introduce many topics for consideration as you choose your method for treatment.

What prompted you to get involved with self-ligating brackets? Do you still use other types of brackets—and if so, how do you decide which to use here?

Dr Stuart Frost: When I worked as a general dentist in my father’s practice, I noticed some things that concerned me in patients who came back from their orthodontists. More than half of them were getting four bicuspids extracted, and I was asked to extract upper bicuspids on my own brother in law, who was 22 at the time. I will never forget the day I pulled those upper bicuspids on him. I remember thinking how I wished I didn’t have to do that.

“…”

There were other things, as well—I noticed quite a bit of root shortening, gingival stripping and bone loss with the cases that were being treated. Many of these patients had been in treatment for five or more years. When I started my orthodontic residency, Dr Paul Damon was in the class ahead of me and one day he mentioned that his father was going to speak to the orthodontic residents and faculty about his new bracket system. I showed up on that Saturday in 1997 and sat in the front row of the auditorium. As I listened to Dr Dwight Damon speak, I remember him saying that the tissues would be better and there’d be less root shortening. This spoke to me because I realized what I saw in my years as a general dentist. After seeing Damon’s cases, which were beautiful and unlike any other case finishes I had ever seen, I knew that I was going to use passive self-ligation in private practice. I opened my practice from scratch in 2000 with the Damon system as my primary appliance.
There are two types of self-ligating brackets—active and passive self-ligating brackets. Which is better, and what are the differences, and which do you prefer?

The differences between passive and active self-ligating brackets is small, but I’ve found that there’s a big difference during treatment and the outcomes that they produce.

“Passive” means that there is a door that slides over the slot, creating a tube in which the wire slides through all phases of the treatment and the wire is passive in the mechanics that it can move freely and has play in all dimensions until a full wire is introduced and a torque is applied. This creates a low-friction environment, allowing the tooth to move more efficiently, and with less friction and binding between the bracket and wire.

Active self-ligation has a clip that closes over the slot, rather than a door that slides over it. Although both systems act similarly in the beginning stages of treatment, active self-ligating brackets introduce friction and binding once the patient reaches rectangular wires. In my opinion, this creates a disadvantage for the Wireless system, because even in treatment binding in the brackets introduces a binding between the wire and the bracket.

One advantage that active-clip systems claim is early torque control in the anterior, but the posterior binding isn’t talked about much. If the goal in both systems is taking anterior crowding and developing it into posterior arch width, then remember passive throughout all phases of the bonding and the broadening of the arches and less trauma on the roots and tissues. With passive self-ligation, torque is increased gradually as the wire size increases and a coupling occurs. My goal in treatment is to stay as passive as possible, which allows for play in the bracket slot, the best setting of the occlusion and the broadest arches without binding and friction.

We often hear that self-ligating brackets have certain advantages—faster finishing, for example. How have you seen this play out in your clinical practice?

I think the biggest advantage we see for self-ligating brackets is the use of especially passive self-ligating brackets—appear in the beginning stages of treatment, especially in cases that have moderate to severe crowding because there is less friction and binding. I’ve been able to solve anteroposterior issues without extracting teeth by creating transverse arch width.

I’ve seen this create a three-to-four-month advantage over using twin brackets to solve the same issues. By saving time in the initial stage, it can make up time in finishing. With passive self-ligating brackets (PSL), I’m able to see the patients every six weeks, which allows me to be more efficient in practice and patients appreciate not having to return to the orthodontist every four to six weeks, which is normal with traditional systems. I’ve also found that if I finish anywhere from four to six months earlier than the national averages of finishing with twin brackets.

How do clinicians know if they are maximizing the brackets? What timing is recommended?

The key to using a passive self-ligating bracket is to treat it less like a bracket and more like a system. Unfortunately, many doctors try to use a PSL bracket using twin-bracket mechanics and run into problems. I’d say there is a steep learning curve in the beginning, because the way you use a PSL bracket is very different from what’s taught in school on how to treat with a twin bracket.

The other learning curve is training your team members on how this new technology works—how differently they engage the wires and brackets, and how this translates to the patient treatment. For example, for the system to work, we don’t tie the wire in or use a powerchain very often because of the amount of friction created. This would cause a lot of the bonding to fail due to the lack of friction, thus causing the benefits of a passive self-ligating bracket to be minimized.

There is a different mind set when using less friction and lower forces. We no longer think about how big of a wire can fit in the slot, but rather how to use the lowest force possible to move this tooth and get optimal results.

Which materials and arch wires work best with self-ligating brackets? Do they work well with other wires as well?

I think the key to this is that we understand that we create a tube with the self-ligating bracket slot with the wire inside, which allows us to have reduced friction and binding to create more amazing arch widths. In my opinion, any wire would work well in a passive self-ligating bracket, but I’ve found that Damon created his arch wire shapes to mimic those of Fränkel’s work. Fränkel showed that when you balance the facial musculature, the tongue, the teeth and pressures that are involved in the maxillary and mandibular arches, a natural arch form develops. I’ve heard Damon speak about this arch form many times. This shape is such that the first incisor—not the cuspid—is the widest part of the arch. This creates a natural, beautiful shape that is broad and wide, supporting the features of the face.

With that being said, if you put any wire into a self-ligating bracket, you’re going to see things work well. Ormco has come up with an excellent combination of copper-nickel-titanium wires that’s very efficient. I often hear of a doctor using the Damon System with another company’s wires and it makes me uncomfortable. It would be like driving a sports car and putting regular octane gas when premium gas is what is recommended.

What design changes have been most important to you over the years and/or recently?

The most important design change for me has been the Damon Q bracket—more specifically, the vector design. We call it the “spike” bracket, and it opens and closes very smoothly and efficiently. With passive self-ligating brackets, you want to get the teeth opened and closed without putting any pressure on the tooth, to avoid causing any discomfort for your patient.

The most recent change that has affected my practice and tightened tolerances that have been introduced with the most recent Damon Q brace that just hit the market. With these tightened tolerances, I’ve been able to have more rotational control and control with the bracket, creating beautiful results overall.

With so many companies offering these brackets, what qualities do you think clinicians should be looking for in the brackets, and which ones use them in their practices? With so many companies offering these brackets, I think that the qualities that clinicians should look for are:

- How long has the company been making PSL brackets?
- Is this just a bracket, or is there a system involved?
- I would also find out how many versions the company has of its current bracket. A company that is dedicated to innovations and change is what I want to buy my brackets from. Every year, Apple brings out an updated version of the iPhone, and people stand in lines to get the latest innovation and technology; I want the same for my brackets.
- What kind of education does the company provide? Does it provide support resources for doctors to be educated on how to use the system? Does it offer courses and forums to help doctors be better and get better results?

Some clinicians have expressed concerns that self-ligating brackets come with their own challenges or issues. Have you had these experiences as your practice has grown?

Any bracket and system has challenges—it really comes down to which system has the heart of them. PSL can be a blessing and a curse. When you have a tube with a wire that doesn’t entirely fill up a slot, you can see unwanted issues. I think the biggest challenge is space that’s developed; if you’re not careful, you can end up with excess space in the anterior and have to deal with that.

The other issue is wire sliding and causing poking emergencies. I’ve addressed these issues by educating my team on how to take the case up from the beginning, and score every wire interval. We will alter the anterior when we put rectangular wires in to avoid space opening up, and we will leave the initial wires out of the lower 6 to avoid the wire coming out and poking the patient.

I’ve also heard doctors using PSL say that they can’t finish well. I’ve found that the doctors who say they can’t finish well can’t finish well in any other bracket system, either.

We’ve talked a lot about this technological perspective, so now we’re on to things patients will ask about. How do self-ligating brackets benefit the patients—are there measurable differences in time, comfort, recall or smell? Are there any challenges in persuading patients to use these brackets—and if so, how do you encourage them to do so?

Patients come into my office every day asking for a wider, broader smile. I have people tell me that they’re able to tell if they’ve been treated by my office just by the way the smile looks. The arches are broader and the arch shape looks different than traditional brace ties.

Many of my adult patients going through braces for a second time often comment, “These don’t hurt nearly as much as the last time.” With the older twin brackets, patients remember being in pain during the treatment. Now, that isn’t generally seen for more than a day or two. My patients also comment on how the brackets are more comfortable and less sharp than other brackets.

Although kids love colour O-trays, parents worry that the Damon system has a door instead of using the colour, which can collect plaque and food.

The other comment patients make is that they love the fact that they don’t have to be seen for six weeks between appointments.

Overall, I think the biggest thing that patients love about self-ligating brackets is the idea that orthodontic technology has changed for the better. People see all the technology changes in the world and they expect that the orthodontic community has changed as well. They love knowing they have the latest and greatest bracket and wire technology being used to straighten their teeth and create a beautiful smile.

If you told me tomorrow that I couldn’t use passive self-ligation, I would seriously consider retraining!
Tongue star 2 (TS2) – System for rapid open bite closure

By Dr John Constantine Voudouris, Canada

Introduction
The aim of this article is to discuss a new system to treat severe skeletal open bite malocclusion using a new miniaturised tongue star 2 (TS2) device. In the first part, the author will focus on clinical evaluation of TS2, the second part is devoted to lingual thrusting, open bite ortho and its treatment.

Clinical evaluation of TS2
Methods
Clinical applications of the first generation of the tongue star devices with nine rounded protrusions, initially manufactured as one piece, were evaluated over a two year period in a second generation tongue star 2.

The new TS2 was made in Italy by SIA Orthodontic Manufacturer as a four-piece unit including a body with six tie-wing undercuts forcrowed plates, bonded to the bonding pad for greater flexibility, and 20 gauge mesh for higher bond strength against lingual shearing forces.

For each orthodontic patient, TS2s were bonded, including six tongue stars positioned on the posterior and middle-third of the upper six anterior teeth from canine to canine, as well as six tongue stars were placed on the lingual middle-third of the lower anterior teeth from canine to canine.

TS2s were the central device of a four component system to treat severe anterior, and lateral tongue positioning. The second component of the system included tongue stars bonded at the same time as a Stainless twin, active self-ligating appliance that employed the third component of new initial Nitro Arch wire for light force control. These specialized archwires with a higher vertical dimension than horizontal dimension (for example 0.019 x 0.025) acted closer to the center of resistance of the teeth for earlier moments of incisor torque, and were incorporated with curve of Spee for the lower archer, and reverse compensating curve on the upper arch to further facilitate incisor re-eruption. The fourth component of the system included a vertical box elastic from the upper lateral incisors to the lower canines (14, 54, 45) that was additionally applied on the lateral aspects for light incisor re-eruption in conjunction with the TS2.

Clinical results and conclusions
This were found to be highly effective in restricting anterior tongue positioning for rapid open bite closure (BOC). No clinically significant root resorption was noted that appeared to be related to the light forces applied. Therefore tongue stars are recommended for rapid open bite closure since they cause the tongue to be retracted during treatment to permit anterior denti c re-eruption.

Multi-directional forces of anterior tongue positioning (tongue thrusting)
Tongue thrusting alters the alignment of the dentition because it has one of the strongest sets of muscles in the human body capable of reflex. Malocclusions involving open bites are classified as two types, anterior open bite located in the area of the anterior nose to canine area and lateral open bite located at the premolars and molars. In open bite malocclusions, the tongue attempts to seal the oral cavity for effective swallowing (puttu-effect) in an unnatural, anterior position. In addition, the tongue thrusts both suprasyne and inferiorly. This results in progressive opening of the bite preventing eruption of the upper and lower incisors. It is significant that both the upper and lower incisors are not only intruded, but also proclined often by the unnatural anterior tongue position between the incisors. Several factors have been associated with open bites.

What is TS2?
The first tongue star was developed in 1994 with nine-ronded protrusions, bonded at the tip to prevent anterior tongue positioning. It was manufactured as one piece bracket and tested clinically for two years by the author in his private orthodontic practice in Toronto, Canada. This first generation tongue star was found to be effective in controlling the tongue for BOC. As a result, new modifications were then implemented by the author to improve the first generation tongue star (TS1).

>Page 14

Figs. 3A & B: Lateral open bites commonly associated with skeletal malocclusion and frequently have an FMT etiology, producing secondary mouth breathing and a chronic interal between a lower tongue position and concurrent muscle activity (floral muscles).

Figs. 4A & B: Tongue Star 2 with anterior box elastic, and active self-ligating brackets shown, and found to be highly effective and efficient system for rapid open bite closure (BOC) of severe skeletal anterior and lateral open bites.

Figs. 5A & B: 6-year-old patient demonstrating that the anterior tongue positioning is addittionally direct edly affecting the preclusion of the lower incisors, supporting the indication that TS2 need to be placed in both the upper and lower arch.

Figs. SC & D: The panoramic radiographic images related to TS2 demonstrated a coronal occlusion with a large anterior overjet and a corresponding reduction in mandibular incisor overbite.
The second generation T22 was made in Italy by MIA Orthodontic Manufactory, as a four-piece unit including:
1. Bracket body with nine rounded protrusions and six new, tying-underneath pieces.
2. Braze (for flexibility) to a bending pad.
3. Separate RO-gauge mesh for greater shear resistance and bend strength.

The separate application of RO-gauge bending mesh is used to improve bond strength during shearing forces on the lingual T22s are manufactured in size similar to bendable buttons to be comfortable for patients and to facilitate oral hygiene. In addition, tie-wings like underruns are designed into six of the nine protrusions to secure the placement of crossbite elastics. This is required commonly in lateral open bite treatment that is associated with severe skeletal maxillary constriction (Figs. 2a & b).

Where should T22 be placed?
Clinically, T22s are bonded on the middle third regions of the upper and lower canine-to-canine region (Figs. 2a & b). The T22 position recommended for the upper anterior is just gingival to the middle third to prepare for the correct upper incisors to approach contact with the lower incisors during rapid open bite closure. This provides a total of 21 T22s on the day of first bonding of a full stainless steel, active self-ligating appliance recommended with new 0.014" x 0.025" NITI, Archwire (MIA Orthodontic Manufacturer). In addition, for each open bite treatment, T22s are applied in conjunction with anterior cross elastic (0.014" x 0.045" seen in Fig. 4b) from the lateral aspects of the upper lateral incisors to the lower canines to facilitate a rapid open bite closure (Figs. 4a & b). This completes a system composed of four components for rapid open bite closure.

Why apply T22?
Normal swallowing takes place approximately 600 times/day or more (including chewing and speaking) the tongue is generally positioned in the palate. However, in anterior open bites the tongue fills the open bite space through anterior tongue positioning (previously referred to as tongue thrusting). T22s are applied for both Rapid Open Bite Closure and for Rapid Lateral Open Bite Closure (Figs. 4a & b). They are used in conjunction with active self-ligating appliances due to the low resistance shown in vitro to permit free and controlled movement of the upper and lower anterior teeth. Once the incisors begin to develop a positive overbite relationship, the palatal positioning begins to retract posteriorly into a more natural tongue position assuming the anatomy of the open bite has been additionally controlled for (excise, nasal obstruction).

When should T22 be placed?
T22s are recommended at all ages including for both early interceptive treatment in children (Figs. 5a & b) and in adults. The ideal recommended time of placement is at the time of placement of active self-ligating brackets that are regularly positioned on the lateral aspects. T22s and active self-ligating brackets work ideally and synergistically with specialized arch wires that have a higher vertical dimension than horizontal dimension (for example 0.016" x 0.045") to be closest to the centre of resistance for earlier incisor moments of tongue and control required for open bite correction. The archwires incorporate curve of Spee for the lower arches and reverse compensating curve on the upper arches to further facilitate incisor re-reposition. T22 incisor reposition is further facilitated by the alignment of the anterior teeth, where a labial box elastic can be placed that also restrains the tongue (please see Fig. 6b). Clinically significant root resorption was found with the use of this light force system that reduces the unnatural and multi-directional anterior, posterior, interior and lateral tongue forces.

How does T22 work?
The basic mechanism of action is that the T22 produces a negative conditioning reflex response for anterior tongue positioning. This is similar to a best-day-effect (Fig. 6a). However, due to the rounded edges of the nine protrusions the tongue is not lacunarized, nor is the operator’s glove or skin. The feeling against the finger is one of coarse sandpaper as a simple reminder for the tongue to stay retracted away from the open bite. This permits the T22s to work effectively in conjunction with the anterior box elastic (0.016” x 0.045”) for rapid open bite closure (ROB shown in Fig 6b). In lateral open bite patients where the T22s are placed at the premolars and molars erosion elastics are applied, that are generally heavy (0.016” x 0.045”), to further prevent lateral tongue positioning while maxillary expansion is completed simultaneously. In addition, it is important that the patient is instructed to exercise swallowing with the tongue in the roof of the mouth from the day of T22 placement.

Special procedures with T22s and overcorrection of open bites
At anterior open bites are corrected it is important to observe the gingival positions of the T22s for the possible need of reduction with a high-speed to prevent dental interference. The objective is to overcorrect the open bite to be greater than 50% openbite for long-term retention. The reason is that open bites are often associated with patients growing with the mandible in a downward and backward direction. It is additionally recommended that upper and lower brackets from canine-to-canine be bonded 1 mm toward the gingival than the customary average height position to facilitate open bite closure. This is particularly important at the upper lateral incisors that are the smallest of the incisor teeth and affected most by the upper anterior, anterior tongue-positioning forces.

Conclusions
Advantages of T22 applications
A system of four components was developed and tested to produce rapid open bite closure. This included the use of new tongue start, anterior box elastic with active self-ligating brackets with new archwires to provide freedom of movement of the system including upper and lower archwires and its proven low resistance, in vitro.

In conclusion:
1. Metal T22s are highly effective and efficient channeling for ROB.
2. Efficiency is gained by ready-made, bendable T22s, that do not wear, are manoeuvred for patient comfort and facilitate oral hygiene.
3. T22s are placed on all 12 anterior dental units from the anterior canines-to-canines, and lower canine-to-canine since the tongue was observed and found to be positioned anteriorly, superiorly and inferriorly.

T22s are applied in conjunction with anterior box elastic (0.016” x 0.045”) and ideally with new, low profile active self-ligating brackets with NITI wires for light, continuous forces for the periodontal membrane, completely fluoride coated for aesthetics, and with progressively lower forces from molars to incisors. Active self-ligating brackets make use of reduced resistance found in vitro and active seating of arch wires for earlier moments of tongue that are closer to the centre of resistance of the incisors to improve control (future publications).

References

About the Author
Dr Iain Constantine Mckendrick montreals teaching positions at the University of Toronto, as an associate in the discipline of Orthodontics, for 13 years, teaching non-oxide advancement appliances, and at the McGill University, in the Division of Biological sciences for 18 years, teaching active self ligating. He is a full member of the Eastern Chapter of the Edward H. Angle Society of Orthodontists and the recipient of the prestigious American Association of Orthodontists Minto Hellman Research Award for molecular growth modifications and genetic face modeling with intert appliances, applying electrophysiological and histological investigation. Dr McKendrick maintains a private orthodontic specialty practice in Toronto, Canada.

Fig. 6a & b. The retraction reflex mechanism shown with T22s. (b) Application of anterior box elastics and active (1. 0).