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

By Dr Daniel Grib, 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 resigned. But judging from the discussion I recently had with experienced dentist Dr Stuart Frost (picture), 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-ligation; 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 Artistic Orthodontist: Creating the Artistically Beautiful Smile more than just straightening teeth—I am 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 would be best?
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 12 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, he mentioned that this passive self-ligation bracket would create beautiful smiles with fewer extractions, faster treatment times, and less headgear and expansion. 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 orthodontic appliance...
There are two types of self-ligating brackets—active and passive self-ligating, and the difference, and which do you prefer? The differences between passive and active self-ligating brackets are small, but I’ve found that there’s a big difference during treatment and in the outcomes 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 wire sequencing and treatment. The wire is passive in that it moves and changes until the archwire is finished and in place. In my opinion, this creates a disadvantage for the archwire system. Because of the design, the door is firmly in place until the entire wire is finished and the archwire is finished. 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 archwire system, because even in treatment binding in the brackets introduces binding between the wire and the bracket.

One advantage that active-ligature wire 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 remaining passive throughout all phases of treatment allows for the broadening of the arches and less trauma on the roots and tissue. 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 settling of the occlusion and the broadest arches without binding and friction.

We often hear that self-ligating brackets have certain advantages or faster finishing, for example, How have you seen this play out in your clinical practice? I think the biggest advantage we see for both self-ligating brackets has to do with especially passive self-ligating bracket systems—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 anterior crowding 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 doing this in the initial stages, it can make up time in finishing. With passive self-ligating (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 see the orthodontist every four to six weeks, which is the norm with traditional brackets. I’ve also found that 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 bracket? What is your learning curve involved? The key to using a passive self-ligating bracket is to treat as less like a bracket and more like a system. Unfortunately, many doctors try to use a PSL bracket using twin-bracket mechanics and run problems into the treatment. I’d say there is a steep learning curve in the beginning, because you use a PSL bracket very differently 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 relates to the patient treatment. For example, for the system to work, we don’t tie the wire into wire power chain very often because of the amount of friction it creates. This would cause a lot of binding to the wire due to the size, thus causing the benefits of a passive self-ligating bracket to be minimized.

There is a different mind-set when using less friction and low 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 archwires work best with self-ligating brackets? Do they work well with other wires as well? I think the key here 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 bicuspid—not the cusp—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 are 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.

How does changing bracket design change the patient experience? In recent years, we have seen a significant shift in orthodontic treatment, with a focus on improving patient comfort, reducing treatment time, and minimizing the appearance of brackets. The introduction of self-ligating brackets has revolutionized orthodontic treatment, offering several advantages over traditional brackets.

Self-ligating brackets, such as Damon brackets, are designed to reduce friction and binding, allowing teeth to move more efficiently. This reduces patient discomfort and can result in faster treatment times. Additionally, self-ligating brackets often have a more esthetic appearance, which can be particularly appealing to patients.

Some clinicians have expressed concerns that self-ligating brackets come with their own challenges or issues. Have you addressed these issues and how have you responded to them in your practice so far? Any bracket system and treatment plan can present challenges, especially when it comes to patient comfort and orthodontic outcomes. However, self-ligating brackets offer several benefits over traditional brackets, making them an attractive option for many patients.

The Damon system, for example, introduced the concept of "zero" braces, which means that there are no tiny metal brackets to add to the discomfort. Instead, these brackets are "wired" directly to the teeth, eliminating the need for small metal brackets.

The Damon system also uses "light cancellation," which means that the wires are designed to dampen vibrations and reduce the "buzz" that can be associated with traditional brackets. This can help reduce patient discomfort and make treatment more comfortable.

Overall, the Damon system has been designed to improve patient comfort and streamline orthodontic treatment. While it may not be the right choice for every patient, it is a valuable option for those looking for a more comfortable orthodontic experience. As with any treatment, it is important to consult with a qualified orthodontist to determine if the Damon system is the right choice for your needs.
Tongue star 2 (TS2) – System for rapid open bite closure

By Dr John Constantine Vouvduris, Canada

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

Clinical evaluation of TS2
Methods
Clinical applications of the first generation of the tongue star devices with tone reduced 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 for crown-like elastic, bonded to the bonding pad for greater flexibility, and Occlusal face for higher bond strength against lingual shearing forces.

For each orthodontic patient, TS2s were bonded, including six tongue star segments positioned on the palate. Brackets were placed on the middle-third of the upper six anterior teeth from canine to canine, and 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 steel, self-ligating appliance that employed the third component of the new system, the NTI® Arch wire for active control. The specialized archwire has a higher vertical dimension than horizontal dimension (example 0.10 x 0.045) that was additionally applied on both sides to avoid incisor re-eruption in conjunction with the TS2s.

Clinical results and conclusion
This was found to be highly effective in restoring anterior tongue positioning, lowering anterior incisors, and reducing tongue thrusting.

However, tongue stars are recommended for rapid open bite closure since they cause the tongue to be retracted during treatment to prevent anterior dentition re-eruption.

Multi-directional forces of anterior tongue positioning (tongue thrusting)
Tongue thrusting affects 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 cause to canines area and lateral open bites located at the premolars and molars. In open bite malocclusions, the tongue attempts to seal the oral cavity for effective swallowing (coughing-effect) in an unnatural, anterior position. In addition, the tongue thrusts both superioirly and inferiorly, This result 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 predispensed by the unnatural anterior tongue positioning between the incisors. Several factors have been associated with open bites:

1. Mandibular underdevelopment
2. Nasal obstruction from e.g. adenoid hypertrophy
3. Myofunctional disorders
4. Tongue dysfunction
5. Muscle overactivity
6. Dental history

What is TS2?
The first tongue star was developed in 2006 with nine-reinforced protrusions bonded at the tip to prevent anterior tongue positioning. It was manufactured as a one-piece bracket and tested clinically for two years by the author in his private orthodontic clinic in Toronto, Canada. The first generation tongue star was found to be effective in controlling the tongue for RBD. As a result, new modifications were then implemented by the author to improve the first generation tongue star (TS1).

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Figs. 3A & B: Lateral open bites commonly associated with skeletal maxillary constriction frequently have an NTI® appliance, producing secondary mouth breathing and a disinclination between a lower tongue position and buccinator muscle activity (oral myology).

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

Figs. 5A & B: A 16-year-old patient demonstrating that the anterior tongue positioning is additively directed and effectively results in the occlusion of the lower incisors, supporting the indication that TS2 need to be placed in both the upper and lower arch.

Figs. 6A & B: The cephalometric scan that demonstrates anterior tongue positioning (TS2) often associated with nasal obstruction related to elongated and chronically inflamed turbinates, secondary mouth breathing, and maxillary overgrowth.
The second generation T2S was made in Italy by STA Orthodontic Manufaktur, as a four-piece unit including:

1. Bracket body with nine rounded protrusions and six new, thinning undercuts.
2.巴西 (for flexibility) to a bending pad.
3. Separate 80-gauge mesh for greater shear resistance and bend strength.

The separate application of 80-gauge bending mesh is used to improve bond strength during shearing forces on the lingual T2S are manufactured in size similar to bondable brackets to be comfortable for patients and to facilitate oral hygiene. In addition, the wire-like underraces are designed into six of the nine protrusions to secure the placement of composite elastic. This is required commonly in lateral open bite treatment that is associated with severe skeletal maxillary constriction (Figs. 2a & b).

Where should T2S be placed?

Clinically, T2S are bonded on the middle-third region of the upper and lower canine-to-canine regions (Figs. 3a & b). The T2S position recommended for the upper anterior is just gingival to the middle third to prepare for the corrected upper incisors to approach contact with the lower incisors during rapid open bite closure. This provides a total of 72 T2S on the day of first bonding of a full stainless twin, active self-ligating appliance recommended with new Slide-N-Slide NiTi, (OrthoMagne STA Orthodontic Manufaktur). In addition, for each open bite treatment, T2S are applied in conjunction with anterior box elastics (6/5, 0.5 oz; see Fig. 6b) from the lateral aspects of the upper lateral incisors to the lower canines to facilitate a rapid open bite closure (Figs. 4a & 4b). This completes a system comprised of four components for rapid open bite closure.

Why apply T2S?

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). T2S are applied for both Rapid Open Bite Closure and for Rapid Lateral Open Bite Closure (Figs. 4a & 4b). 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 posterior overbite relationship the anatomy of the open bite has been additionally controlled (for example, nasal obstruction).

When should T2S be placed?

T2S are recommended at all ages including for both early interceptive treatment in children (Figs. 5a & b) and adults. The ideal recommended time of placement is at the time of placement of active self-ligating brackets (that are regularly positioned on the labial aspects) T2S and active self-ligating brackets work ideally and synergistically with specialised arch wires that have a higher vertical dimension than horizontal dimension (for example 0.96 = 0.26) to be closest to the centre of resistance for earlier incisor movements of tongue and control required for open bite correction. The archwires incorporate curve of Spee for the lower arches and reverse compensating curves on the upper arches to further facilitate incisor re-eruption. T2S incisor re-eruption is further facilitated by the alignment of the anterior teeth, where a labial box elastic can be placed that also restricts the tongue (please see Fig. 8b). No clinically significant root resorption was found with the use of this light force system that reduces the unnatural and multi-directional anterior eruptive force, interior and lateral tongue forces.

How does T2S work?

The basic mechanism of action is that the T2S produces a negative conditioning reflex response for anterior tongue positioning. This is similar to a bite-block effect (Fig. 6a). However, due to the rounded ends of the nine protrusions the tongue is not lacerated, nor is the operator’s glove or skin. The feeling against the finger is one of coarse sandpaper as a reminder for the tongue to stay retracted away from the open bite. This permits the T2S to work effectively in conjunction with the anterior box elastic (6/5, 0.5 oz; see Fig. 6b) for rapid open bite closure (ROC) shown in Figure 6b. In lateral open bite patients where the T2S are placed at the premolars and molars, continuous elastics are applied, that are generally heavy 1/4, 0.5 oz, 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 T2S placement.

Special procedures with T2S and overcorrection of open bites

As anterior open bites are corrected it is important to observe the gingival protrusions of the T2S for the possible need of reduction with a high-speed to prevent dental interference. The objective is to overcorrect the open bite to greater than 30% overbite 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 positions to facilitate open bite closure. This is particularly important at the upper lateral incisors that are the smallest of the incisor teeth and affected much by the aspects of the upper anterior tongue positioning forces.

Conclusions

Advantage of T2S 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 elastics with active self-ligating brackets with new archwires to provide freedom of movement of the system allowing the upper and lower archwires with its proven low resistance, in vitro.

In conclusion:

1. Metal T2S are highly effective and efficient channels for ROC.
2. Efficiency is gained by readily made, bondable.
3. T2S that do not move are modified for patient comfort and facilitate oral hygiene.
4. T2S are placed on all 12 anterior dental units from the canine to canine, and lower canine to canine since the tongue was observed and found to be positioned anteriorly, superiorly and inferiorly.

T2S are applied in conjunction with anterior box elastic (6/5, 0.5 oz) and ideally with new low profile active self-ligating brackets with resin clips for light, continuous forces for the posterior dental units, completely fused to the archwires 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 publication).

References


About the Author

Dr. Sanjiv Constantine Meckrum practices teaching practices at the University of Toronto, as an associate in the discipline of Orthodontics, for 15 years, teaching non-invasive braces equipment, and is an active member in the American Association of Orthodontists. He has a private orthodontic specialty practice in Toronto, Canada.