Self-ligating brackets

A discussion of the pros, cons and specifics

By Dr Daniel Crook, 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clear aligner therapy—some clinicians may feel like the days of brackets and wires are over, or seen to be completely outdated. But judging from the discussion I recently had with experienced dentist Dr Stuart Trust (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-ligating systems, 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 in More Than Just Straightening Teeth—Trust is supremely qualified to introduce many topics for consideration as you choose your method for treatments.

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 works best?

Dr Stuart Trust: 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, I remember him saying that the tissues would be better and there’d be less root shortening. That 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 finishing 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 system of choice.

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Unintended changes to occlusion following the provision of night guards

By King’s College London

Based on a series of clinical findings by King’s College London, cases have been presented where night guard use resulted in anterior open bite and associated occlusal alteration. One featured case involved an orthodontic retainer. The orthodontist change observed is discussed in a review of the literature recently published in the British Dental Journal on night guards.

This left questions unanswered about the risk and possible causes of occlusal alteration linked to night guard design and use.

The research, led by Dr Tom Boonemiddel, Honorary Clinical Teacher at the Faculty of Dentistry, Oral & Craniofacial Sciences at King’s College London, concluded that adverse occlusal effects linked to the use of night guards and orthodontic appliances may be found to be more common than anticipated from existing literature.

Patient follow-up is essential to monitor the use and effects of these appliances regardless of appliance type. Unintended occlusal changes may result. The conclusion was that use and effects of partial coverage appliances require more careful monitoring than commonly believed.

Suggestions are provided for information and written instructions to be given to patients to be provided with night guards and removable orthodontic retainers.

A future article will deal with the various treatment options for these cases and show the successful reversal of the desired occlusions.

Read the article in full on the British Dental Journal website here: https://www.nature.com/articles/s41421-018-0069

Just scan the QR code and get further details.
There are two types of self-ligating brackets—active and passive self-ligating, and it makes a difference, and which do you prefer?

The differences between active and passive 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 slips through all phases of wear sequencing and treatment. The wire is passive in its movement that it can move freely and has play in all dimensions until a full wire is introduced and a torque is cycled. 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 wire, because even in treatment binding in the brackets introduces binding between the wire and the bracket.

One advantage that active-by-unsilting units claim is easier 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 bonding is important in the broadening of the arches and less trauma on the roots and tissue. With passive self-ligations, 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 bracket 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 specifically 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 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 saving time in the initial stage, it can make up time in finishing. With passive self-ligature (PSL), I'm able to see the patients every four 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 twin brackets). I've also finished the entire case from four to six months earlier than the national averages of finishing with twin brackets.

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 relates to the patient treatment. For example, for the system to work, we don't tie the wires in or use a power chain very often because of the amount of friction it creates. This would cause a lot of friction due to the size of the wire, and it in turn, enough to cause the arch form to be something else, because of the increased friction, and the wires are not as 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. Omron has come up with an excellent combination of copper-nickel-titanium wires that's very efficient. I often hear of a doctor using the Omron system with another company's wires and it makes me uncomfortable. It would be like driving a sports car and putting regular unleaded 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 more design. We call it the "spikie" dock, and it opens and closes very smooth and efficiently. With passive self-ligating brackets, you want to get the door opened and closed without putting any pressure on the tooth, to avoid causing any discomfort for the patient.

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

With so many companies offering these brackets, what qualities do you think clinicians should be looking for or the advantages that one system has over its competitors?

When choosing an orthodontic bracket, I think the qualities that clinicians should look for are:

- Long-term brackets are being made by PSL brackets
- It is a just a bracket, or is there a system involved?
- I would also find out how many many software versions the company has its current bracket. A company that is dedicated to innovation and change is where I want to keep my brackets from. Every year, Apple brings out a new 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. How have you addressed these issues in your practice so far?

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 wire 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 pulling emergencies. I've addressed these issues by educating my team on how to take the case up from the beginning, and screen every wire interval. We will use the anteriors 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, but I've found that the doctors that say they can't finish well, PSL can't finish well in any other bracket system, either.

We've talked a lot about the clinical perspective, so now we're on to things patients will ask about. How do self-ligating brackets benefit the patient—are there measurable differences in time, comfort, result, or smile? 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 looks.

Many of my adult patients going through braces for a second time often comment, "These don't hurt anywhere near as much as the last time."

With the older twin brackets, patients remember being in pain and uncomfortable. It's not the case any longer. I think generally aren't seen for more than a day or two. My patients also comment on how the bracket are more comfortable and less sharp than other brackets.

Although kids love colour T-shirts, parents are a little bit hesitant that the Damon system has a door instead of using the colours, 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.
Tongue star 2 (TS2) – System for rapid open bite closure

By Dr John Constantine Voudouri, Canada

Introduction
The aims 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 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 mini 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 Manufacturing as a four piece unit including a body with six tie-wing undercuts for crown-like contacts, bonded to the bonding pad for greater flexibility, and two aligner blades for higher bond strength against lingual shearing forces.

For each orthodontic patient, TS2s were bonded, including six tongue stars positioned on the palate near the alveolar base, mid-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 Silhouette twin, active self-ligating appliance that employed the third component of new miniaturised tongue star 2 that was additionally applied on the labial aspects for light incisor re-eruption in conjunction with the TS2.

Clinical results and conclusion

This was 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 dentition re-eruption.

Multi directional forces of anterior tongue positioning (tongue thrusting)

The tongue 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 incisors 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 (putting effort) in an unusual, anterior position. In addition, the tongue thrusts both superiorly 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 unusual anterior tongue position between the incisors. Several factors have been associated with open bites.

What is TS2?
The first tongue star was developed in 1989 with nine-reminder protrusions located at the tip to prevent anterior tongue positioning. It was manufactured as one piece and tested clinically for two years by the author in his private orthodontic clinic 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 (TS2).

Fig. S1 & B: Lateral open bites commonly associated with skeletal maxillary constriction frequently have an FFT etiology, producing midline mouth breathing and a chronic imbalance between a lower tongue position and functional muscle activity (facial musculature).

Fig. 2A & B: The recommended position of the tongue stars are mildy more apical for the upper incisors (6).

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

Fig. 5A & B: 4 year old patient demonstrating that the anterior tongue positioning is additionally directed anteriorly resulting in the protrusion of the lower incisors, supporting the indication that TS2 need to be placed in both the upper and lower arch.

Fig. SC & D: The cephalometric reveal that anterior tongue positioning is often associated with nasal obstruction related to collapse and chronically inflamed turbinates (E), secondary mouth breathing, and major overjet.

Fig. S5E & F: Up harmony and balance were shown after BOC using the four component system of TS2, anterior bar elastic, active self-ligating brackets, and specialized anchorage for tongue control.
The second generation T2N was made in Italy by SIA Orthodontic Manufacturer, as a four-piece unit including:
1. Bracket body with nine rounded protrusions and six new, tying-underside.
2. Brazes (for flexibility) to a bending pad.

The separate application of 80-gauge bonding mesh is used to improve bond strength during shearing forces on the lingual T2N. The brackets are manufactured in sizes similar to bondable brackets to be comfortable for patients and to facilitate oral hygiene. In addition, the tie-wings like undercut are designed into six of the nine protrusions to secure the placement of composite elastics. This is required commonly in lingual open bite treatment that is associated with severe skeletal maxillary constitution (Figs. 2a & 6).

Where should T2N be placed?
Clinically, T2N are bonded on the middle-third region of the upper and lower canine-to-canine regions (Figs. 3a & 6). The T2N 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 21 T2N on the day of first bonding of a full stainless-steel active self-ligating appliance recommended with new 0.016 × 0.025 Niti, SA Orthodontic Manufacturer. In addition, for each open bite treatment, T2N are applied in conjunction with anterior box elastics (Figs. 4a & 4b) from the labial aspect of the upper lateral incisors to the lower canines to facilitate a rapid open bite closure (Figs. 4a & 4b). This completes a system composed of four components for rapid open bite closure.

Why apply T2N?
Normal mastication takes place approximately 600 times/day or more (including chewing and speaking) the tongue is generally positioned in the palate. However, in anterior open bite, the tongue fills the open space through anterior tongue positioning (previously referred to as tongue thrusting). T2N 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. Once the incisors begin to develop a positive overbite relationship, the transitivity generally begins to retract posteriorly in a more natural tongue position assuming the anatomy of the open bite has been additionally controlled (for example, nasal obstruction).

When should T2N be placed?
T2N are recommended at all ages including for both early interceptive treatment in children (Figs. 3a & 3b) 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 labial aspect). T2N and active self-ligating brackets work ideally and synergistically with specialized arch wires that have a higher vertical dimension than horizontal dimension (for example 0.017 × 0.025) to be closest to the center of resistance for earlier incisor moments of the 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 reposition. This incisor retraction 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. 4b). No clinically significant root resorption was found with the use of right light system that reduces the unnatural and multi-directional anterior, posterior, inferior and lateral tongue forces.

How does T2N work?
The basic mechanism of action is that the T2N produces a negative conditioning reflex response for anterior tongue positioning. This is similar to a box effect (Fig. 6a). However, due to the rounded ends of the incisors protrusions the tongue is not lacerated, nor is it the operator’s glove or skin. The feeling against the tongue is one of course sandpaper as simply a reminder for the tongue to stay retracted away from the open bite. This permits the T2N to work effectively in conjunction with the anterior box elastics (Figs. 4a & 4b) for rapid open bite closure (ROB) shown in Figure 6b. In lateral open bite patients where the T2N are placed at the premolars and molars, correction of class II elastics are applied, that are generally heavy 0.017 × 0.025, to further prevent lateral tongue positioning while maxillary expansion is completed simultaneously. In addition, it is important that the patient is instructed to exert swallowing with the tongue in the roof of the mouth from the day of T2N placement.

Special procedures with T2N and overcorrection of open bites
At anterior open bites are corrected it is important to observe the gingival positioning of the T2N 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 40% for longterm 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 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 most by the appliance, anterior tongue positioning forces.

Conclusions
Advantage of T2N applications
A system of four components was developed and tested to produce rapid open bite closure. This included the use of new anterior start, anterior box elastics with active self-ligating brackets with new archwires to provide freedom of movement of the system incorporating the upper and lower archwires with its proven low resistance, in vitro.

In conclusion:
1. Metal T2N are highly effective and efficient channels for ROB.
2. Efficiency is gained by readjustable, bendable.
3. T2N, that do not wear, are minimised for patient comfort and facilitate oral hygiene.

T2N are placed on all 12 anterior dental units from the anterior canine-to-canine, and lower canine-to-canine since the tongue was observed and found to be positioned anteriorly, superiorly and inferiorly.

T2N are applied in conjunction with anterior box elastics (Figs. 4a & 4b) and ideally with new, low profile active self-ligating brackets with NiTi archwires for light, continuous forces for the periodontal membrane, completely finish-rolled for aesthetics, and with progressively lower forces from incisors to molars. 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 center of resistance of the incisors to improve control (future publication).

References

About the Author
Dr Jamie Constantine-Mackay is a clinical specialist in orthodontics teaching at the University of Toronto, as an associate in the discipline of Orthodontics. For 13 years, teaching non-cadillac advancement appliances, and at University of Toronto, in the Division of Biological sciences for 18 years, teaching active self-ligation.

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’ Alpha Phi Omega Research Award for mandible growth modifications and general facial remodeling with orthodontic appliances, applying electromyographic, cephalometric and histological investigations. Dr Mackay maintains a private orthodontic specialty practice in Toronto, Canada.

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