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

By Dr. Daniel Gribb, 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 seem to be completely regained. 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-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 More Than Just Straightening Teeth—Frost 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 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, which was difficult. At the time, I would forever remember 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, I learned that Dr. Paul Damon was in the class ahead of me and one day he mentioned that his father was going back to the orthodontists who trained him, and the orthodontists 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 the first self-ligating 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 case, which were beautiful and unlike any other case that I had ever seen, I knew that I was going to use passive self-ligating in private practice. I opened my practice from scratch in 2000 with the Damon system as my preferred appliance.

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 displacement. One case study involved an orthodontic retainer. The ortho of the occlusal changes 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 the occlusal displacement linked to the use of night guard design and use.

The research, led by Dr. Tim Bremnicki, 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 occur. 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 those cases and show the successful reversal of the desired occlusion. 

Read the article in full on the British Dental Journal website here: https://www.nature.com/articles/ sjbd2018848
There are two types of self-ligating brackets—active and passive self-ligating brackets, 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 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 its sliding that it can move freely and has play in all dimensions until a full wire is introduced and a torque is created. This creates a low-friction environment, allowing the teeth to move more efficiently, and with less friction and binding between the bracket and wire.

Active self-ligations have 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 patient, since, because early in treatment binding in the bracket introduces binding between the wire and the bracket.

One advantage that active 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 remaining passive throughout all phases of binding is beneficial because of the broadening of the arches and less trauma on the roots and tissues. 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 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 ability to use a more specifically passive self-ligating bracket—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 taking some 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 now necessary, with standard bracket systems). 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 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 to use this new technology—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 create a lot of friction during the process, which is not going to allow for any tooth movement, and thereby the benefit of a passive self-ligating bracket to be maximized.

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

Which materials and arch wires would work best with self-ligating brackets? Do they work well with all wires alike?

I think the key thing is that we understand what we create a tube with the arch wire in the slot with the wire sitting inside, which allows us to reduce 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 muscles, 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 canine—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 in your experience?

Some clinicians have expressed concerns that self-ligating brackets come with their own challenges or issues. How have you addressed these concerns in your practice so far?

Any bracket system has challenges—it really comes down to how the 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 palatal emergencies. I’ve addressed these issues by educating my team on how to set the case up from the beginning, and across every wire interval. We will wire the anterior when we put rectangular wires in to avoid space opening up, and we will leave the initial wire out of the lower 6 to avoid the wire coming out and poking the patient.

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 didn’t use passive self-ligation, I would seriously consider retraining! I would not be the orthodontist I am today without it.
Tongue star 2 (TS2) – System for rapid open bite closure

By Dr John Constantine Vassouris, 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 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 time 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 for crooked elastics, bonded to the bonding pad for greater flexibility, and 8gauge mesh for higher bond strength against lingual shearing forces.

For each orthodontic patient, TS2s were bonded, including six tongue star positions on the posterior and 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 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 Smartee twin, active self-ligating appliance that employed the third component of new initial NITI (Arch wire for light force control). These specialized arches with a higher vertical dimension than horizontal dimension (example 00” + 04”) acted closer to the comfort of resistance of the root for earlier months of incisor tongue, and were incorporated with curve of Spee for the lower arch, and reverse compensating curve on the upper arches 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 (04 04 04) 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 reflux. Malocclusions involving open bites are classified as two types, anterior open bite located in the area of the anterior cusp-to-cusp 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 (suction-effect) in an unnatural, 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 unnatural anterior tongue position between the incisors. Several factors have been associated with open bites.

Orthodontics of open bite includes:

1. Prae superior and inferior tongue positioning in conjunction with lateral tongue thrusting
2. Allergies, asthma, nasal obstruction from for example nasal septum deviation as a result of chronically inflamed rhinitides, chronically enlarged tonsils and adenoids etc.
3. Primary, habitual mouth breathing (or S), associated often with anterior, superior and inferior tongue positioning.
4. Skeletal downward and backward growth of the mandible (bimaxillary phalanges)
5. Muscle hyperactivity (an extreme pathological example is observed in muscular dystrophy patients)
6. Dental delay of incisor eruption and overeruption of the molars
7. Habits such as thumb-sucking, finger-sucking, blanket-sucking, over retention of teeth after the age of 6.

Several appliances have been developed to control the anterior tongue positioning including the traditional cemented tongue-rods milled to molar bands, and bendable tongue-habit breakers type brackets on the palatal of the upper incisors. These were often bulky, uncomfortable and cumber some for patients.

What is TS2?

The first tongue star was developed in 1992 using nine-centimetre protrusions rounded 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. 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).

Figs. 3A & B: Lateral open bites commonly associated with skeletal maxillary constriction frequently have an IMF orthodontics, producing secondary mouth breathing and a chronic insufficiency between a lower tongue position and buccinator muscle activity (blunt muscle).

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 (BOC) of severe skeletal anterior and lateral open bites.

Figs. 5A & B: A 3-year-old patient demonstrating that the anterior tongue position is adaptively directed exoradically resulting in the proclination of the lower incisors, supporting the indication that TS2 need to be placed in both the upper and lower arch.

Figs. 6A & B: The topographic model that anterior tongue positioning (5°) is often associated with nasal obstruction related to enlarged and chronically inflamed turbinates (5°), secondary mouth breathing, and malocclusion.

Figs. 7A & B: Upper harmony and balance were shown after BOC using the four-parametric system of TS2; anterior box elastic, active self-ligating brackets, and specialized anchorage for tongue control.
The second generation T25 was made in Italy by MA Orthodontic Manufaktur, as a four-piece unit including:
1. Bracket body with nine rounded protrusions and six new, thinning undercuts.
2. Braces (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 T25s are miniaturized in size similar to bendable buttons to be comfortable for patients and to facilitate oral hygiene. In addition, tie-wire like undercuts 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 T25 be placed?
Clinically, T25s are bonded on the middle-third regions of the upper and lower canine-to-canine regions (Figs. 3a & b). The T25 position recommended for the upper anterior is just gingival to the middle third to prepare for the corrected upper incisal to approach contact with the lower incisors during rapid open bite closure. This provides a total of 12 T25s on the day of first bonding of a full stainless-steel, active self-ligating appliance recommended with new nickel-titanium (NiTi) archwires (OPE Orthodontic Manufaktur). In addition, for each open bite treatment, T25s are applied in conjunction with anterior box elastics (0.014" 0.016", 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 & b). This completes a system composed of four components for rapid open bite closure.

Why apply T25?
Normal overeruption takes place approximately 600 times/day or more (including during 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). T25s 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. Once the incisors begin to develop a positive overeruption relationship the tongue generally begins to retract posteriorly into a more natural anterior position assuming the anatomy of the open bite has been additionally controlled (for example, nasal obstruction).

When should T25 be placed?
T25s are recommended at all ages including for both early interceptive treatment in children (Figs. 3a & 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 labial aspects) T25s and active self-ligating brackets work ideally and synergistically with specialised wire that have a higher vertical dimension than horizontal dimension (for example 0.014" = 0.016") to be closest to the centre of resistance for earlier incisor moments of force and control required for open bite correction. The archwires incorporate curve of Spee for the lower arches and reverse compensatory curve on the upper arches to further facilitate incisor re-erection. T25s incisor re-erection 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. 6b). No clinically significant root resorption was found with the use of this light force system that reduces the unnatural and multi-directional anterior eruptive inferior tongue forces.

How does T25 work?
The basic mechanism of action is that the T25 produces a neutral, non-conditioning reflex response for anterior tongue positioning. This is similar to a bed-much effect (Fig. 6a). However, due to the rounded ends of the incisors the tongue is not lacerated, nor is the operator's glove or skin. The feeling against the finger is one of coarse sandpaper as simply a reminder for the tongue to stay retracted away from the open bite. This permits the T25 to work effectively in conjunction with the anterior box elastic (0.016" 0.018") for rapid open bite closure (ROC) shown in Fig. 6b. In lateral open bite patients where the T25s are placed at the premolars and molars crossbite elastics are applied, that are generally heavy 0.016" 0.018", 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 T25 placement.

Special procedures with T25s and overcorrection of open bites
At anterior open bites are corrected it is important to observe the gradual progression of the T25s for the possible need of reduction with a high-speed to prevent dental interferences. The objective is to overcorrect the open bite to greater than 30% overbite for long-term retention. The reason 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 gingiva 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 mandibular anterior tongue-positioning forces.

Conclusions
Advantages of T25s applications
A system of four components was developed and tested to produce rapid open bite closure. This included the use of new lingual start, anterior box elastics with active self-ligating brackets with new wires to provide freedom of movement of the system including the upper and lower archwires with its proven tooth positioning forces.

low resistance, in vitro.

References

About the Author
Dr Iain Constance Mrakouros maintains teaching positions at the University of Toronto, as an associate in the discipline of Orthodontics, for 12 years. He teaches non-extractive appliances, appliance orthodontists, and orthodontists, and has conducted several research projects related to orthodontic appliances. He is the recipient of the prestigious American Association of Orthodontists I. Mrakouros Research Award to non-surgical growth modifications of the jaws, an experienced clinical orthodontist who is recognized internationally for his expertise in clinical orthodontics for 18 years, teaching active self-ligating systems.

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