Tongue Stars 2 (TS2) System for Rapid Open Bite Closure

John Constantine Voudouris DDS, DOrth, MSc(D), University of Toronto, Discipline of Orthodontics, NYU, and Private Orthodontic Specialty Practice, Toronto, Canada

Abstract: The aim is to discuss a new system to treat severe skeletal open bite malocclusion using a new, miniaturized tongue star 2 device. 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 2-year period in the private orthodontic clinic of the author. Improvements were noted and implemented to develop a second generation tongue star 2 (TS2). The new TS2 was made in Italy by SIA Orthodontic Manufacturer as a four-piece unit including a body with 6 tie-wing undercuts for crossbite elastics, brazed to the bonding pad for greater flexibility, and 80-gauge mesh for higher bond strength against lingual shearing forces. For each orthodontic patient, 12 TS2s were bonded, including six tongue stars positioned on the palatal aspects of the gingival 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 anteriors from canine to canine. TS2s were the central device of a 4-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 Siamese twin, Active self-ligating appliance that employed the third component of new initial NiTi iArch wires for light force control. These specialized archwires with a higher vertical dimension than horizontal dimension (for example .018 X .014") acted closer to the center of resistance of the root for earlier moments of incisor torque, and were incorporated with curve of Spee for the lower arches, 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 (1/4", 4.5oz) that was additionally applied on the labial aspects for light incisor re-eruption in conjunction with the TS2s. Clinical Results: TS2s were found to be highly effective in restricting anterior tongue positioning for rapid open bite closure (ROC). No clinically significant root resorption was noted that appeared to be related to the light forces applied. Conclusion: Tongue stars are recommended for rapid open bite closure since they cause the tongue to be retracted during treatment to permit anterior dental re-eruption.

Introduction to 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.1 Malocclusions involving open bites are classified as two types, anterior open bite located in the area of the anterior canine-to-canine 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 (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.

Etiology of open bite includes:

1) Primary anterior, 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 turbinates, chronically enlarged tonsils and adenoids etc.
3) Primary, habitual mouthbreathing (or 2°), associated often with anterior, superior and inferior tongue positioning
4) Skeletal downward and backward growth of the mandible (dolicocephalics)
5) Muscle hypoactivity (an extreme pathological example is observed in muscular dystrophy patients)
6) Dental delay of incisor eruption and over-eruption of the molars
7) Habits such as thumb-sucking, finger-sucking, blanket sucking over-retention of soothers after age 6

Several appliances have been developed to control the anterior tongue positioning including the traditional cemented tongue-cribs soldered to molar bands, and bondable tongue habit-breakers type brackets on the palatal of the upper incisors. These were often bulky, uncomfortable and cumbersome for patients. The purpose of this clinical study was to develop and test a small bondable type device to be effective and efficient in application in an attempt to prevent and control anterior tongue positioning. The second objective was to develop an overall System using the tongue device to for rapid open bite closure.

What is a Tongue Stars 2? Methods

The first tongue star was developed in 2014 with 9-reminder protrusions rounded at the tips to prevent anterior tongue positioning. It was manufactured as a one-piece bracket and tested clinically for 2 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 rapid open bite correction. As a result, new modifications were then implemented by the author to improve the first generation tongue star (TS1). The second generation TS2 was made in Italy, by SIA Orthodontic Manufacturer, in Italy as a four-piece unit including:

1) Bracket body with 9 rounded protrusions and 6 new, tie-wing

undercuts
2) Braze (for flexibility) to
3) Bonding pad
4) Separate 80-guage mesh for greater shear resistance and bond strength

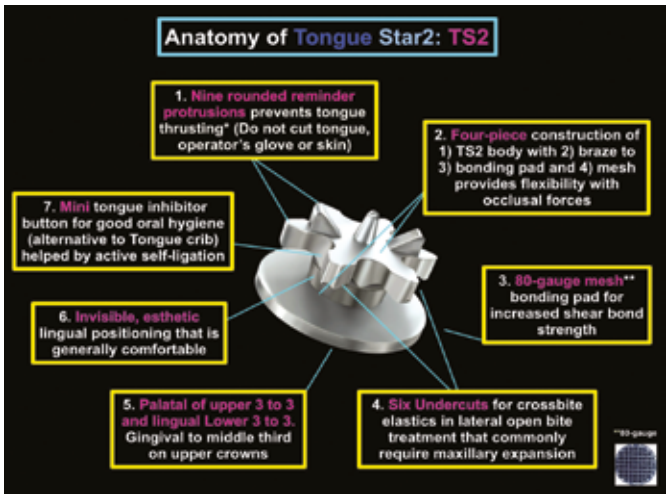


Fig. 1 Anatomy of TS2: The seven characteristic features of the second generation tongue star 2 (TS2) are shown.

The separate application of 80-gauge bonding mesh is used to improve bond strength during shearing forces on the lingual. TS2s are miniaturized in size similar to bondable buttons to be comfortable for patients and to facilitate oral hygiene. In addition, tie-wing like undercuts are designed into 6 of the 9 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 to Place Tongue Stars 2?

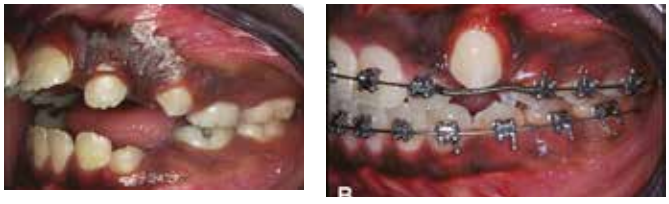
Clinically,TS2s are bonded on the middle-third regions of the upper and lower canine-to-canine regions (Figs. 3A,B). The TS2 position recommended for the upper anteriors is just gingival to the middle third to prepare for the corrected upper incisors to approach contact with the lower incisors during rapid open bite closure. This provides a total of 12 TS2s on the day of first bonding of a full Siamese twin, active self-ligating appliance recommended with new .018" X .014" NiTi, iArch wires (SIA Orthodontic Manufacturer). In addition, for each open bite treatment, TS2s are applied in conjunction with anterior box elastics (1/4", 4.5 oz. see below Fig. 6B) from the labial 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 Tongue Stars 2? Results

Normal swallowing 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

Figs 2A, B. Lateral open bites commonly associated with skeletal maxillary constriction frequently have an ENT etiology, producing secondary mouthbreathing and a chronic imbalance between a lower tongue position and buccinator muscle activity (facial muscles).

Figs 3A, B. The recommended positions of the tongues stars are mildly more gingival for the upper incisors in 3A.



Figs 4A,B. Tongue Stars 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 correction (ROC) of severe skeletal anterior and lateral open bites.

positioning (previously referred to as tongue thrusting). TS2s are applied for both Rapid Open Bite Closure (ROC) 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 anteriors. Once the incisors begin to develop a positive overbite relationship the tongue generally begins to retract posteriorly into a more natural tongue position assuming the etiology of the open bite has been additionally controlled (for example nasal obstruction).

When to Place Tongue Stars 2?

TS2s are recommended at all ages including for both early interceptive treatment in children (Figs. 5A-F) 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). TS2s and active self-ligating brackets work ideally and synergistically with specialized iArch wires that have a higher vertical dimension than horizontal dimension (for example .018 X .014") to be closer to the center of resistance for earlier incisor moments of torque 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-intrusion. TS2 incisor re-extrusion is further facilitated by the alignment of the anterior teeth, where a labial box elastic can be placed that also restrains the tongue

Figs 5A,B. A 9-year old girl demonstrates that the anterior tongue positioning is additionally directed inferiorly resulting in the proclination of the lower incisors. This indicates that need for the TS2s to be placed in the lower arch.
Fig. 5C,D. The radiographs reveal that anterior tongue positioning (C) is often associated with nasal obstruction related to enlarged and chronically inflamed turbinate's (D), secondary mouthbreathing, and molar over-eruption.
Figs 5E,F. Lip harmony and balance are shown following rapid open bite closure using the four-component System of TS2s, anterior box elastics, active self-ligating brackets, and specialized archwires for torque control.

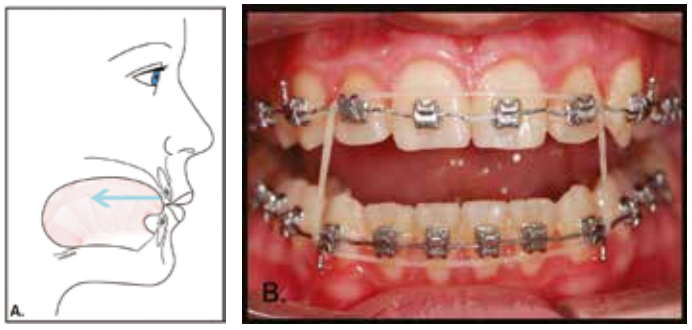


Fig 6A. The retraction reflex mechanism shown with TS2s.
Fig. 6B. Application of anterior box elastics and active SL.

(please see below 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, superior, inferior and lateral tongue forces.

How do Tongue Stars 2 work?

The basic mechanism of action is that the TS2s produces a negative conditioning reflex response for anterior tongue positioning.2 This is similar to a hot-stove effect (Fig. 6A). However, due to the rounded ends of the 9 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 simply a reminder for the tongue to stay retracted away from the open bite. This permits the TS2s to work effectively in conjunction with the anterior box elastics (5/16", 4.5oz) for rapid open bite closure (ROC) shown in Fig. 6B. In lateral open bite patients where the TS2s are placed at the premolars and molars crossbite elastics are applied, that are generally heavy 1/4", 4.5oz, 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 TS2 placement.

Special Procedures with TS2s and Over-correction of open bites

As anterior open bites are corrected it is important to observe the gingival protrusions of the TS2s for the possible need of reduction with a high-speed to prevent dental interferences. The objective is to over-correct the open bite to be 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 1mm 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 most by the unnatural, anterior tongue positioning forces.

Conclusions: Advantages of Tongue Stars 2 Applications

A System of 4 components was developed and tested to produce rapid open bite closure. This included the use of new tongue stars, anterior box elastics with active self-ligating brackets with new iArches to provide freedom of movement of the system including the upper and lower archwires with its proven low resistance, in vitro. The summary is:

1) Metal TS2s are highly effective and efficient chairside for rapid open bite closure (ROC)
2) Efficiency is gained by ready-made, bondable TS2s, that do not wear, are miniaturized for patient comfort and facilitate oral hygiene
1) TS2s are placed on all 12 anterior dental units from the upper canine to canine, and lower canine-to canine
since the tongue was observed and found to be positioned anteriorly, superiorly and inferiorly.

TS2 are applied in conjunction with anterior box elastics (5/16", 4.5oz) and ideally with new, low profile active self-ligating brackets with NiTi clips for light, continuous forces for the periodontal membrane, completely frost-coated for esthetics, 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 iArch wires for earlier moments of torque that are closer to the center of resistance of the incisors to improve control (future publication).

References:

1. Ramford SP, Major MA. Occlusion. Philadelphia, USA: W.B. Saunders Company; 1971. pgs.42, 89-91.
2. Cooper S. Muscle spindles in the intrinsic muscles of the human tongue. J Physiol (London) 1954;122:193.

Dr. John C. Voudouris maintains teaching positions at the University of Toronto, as Associate in Orthodontics, Discipline of Orthodontics for 31 years teaching functional appliances, and at New York University, as Visiting Scholar, Division of Biological Sciences for 18 years, teaching Active self-ligation. He is a full member of the Edward H. Angle East Society, and the recipient of the prestigious American Association of Orthodontist's Milo Hellman Research Award for condylar growth modifications and glenoid fossa remodeling with Herbst appliances applying electromyographic, cephalometric, and histological investigations

SIA ORTHODONTIC MANUFACTURER

PRESENTS XP AND LEONARDO: THE MOST INNOVATIVE RPE LINES

HALL 4.1
B098-C099

The XP line of RPE, made of medical grade stainless steel, is designed to meet the most demanding accuracy requirements, stability and comfort. Its U-shaped laser welded arms ensure high torsion and compression resistance. For an easy use by the patient, the activation hole has been designed with a generous flaring funnel. The XP line doesn't use any chemical components for friction control to be completely safe for the patient.

Features:

- LASER WELDED ARMS
- FULLY MECHANICAL FRICTION SYSTEM
- COMPACT DIMENSIONS
- FUNNEL SHAPED ACTIVATION HOLE

LEONARDO

Rapid palatal expander Leonardo has the best features available on the market, in order to make the users' work more secure, easy and effective. The two parts of the expander's body remain slotted one into the other to ensure rigidity and stability. The arms are laser welded to maximize its resistance to prevent breakage. Its anti-unscrewing system prevents any spin-back effect of the screw. At each turn a "click" sound is heard to warn that the activation is completed.

Features:

- COMPACT DESIGN
- ANTI-UNSCREWING SYSTEM
- MECHANICAL STOP
- LASER MARKED GRADUATE SCALE

Zona Industriale 81040 Rocca d'Evandro Italy - ph +390823 908029 - fax +390823 908028 - info@siaorthodontics.com
www.siaorthodontics.com