Aesthetic concerns are behind the majority of requests for orthodontic treatment with lingual appliances. Added is the request for a treatment that achieves results in a short span of time and causes no functional or psychological discomfort.1

Unfortunately, despite fulfilling the aesthetic needs of patients, many fixed lingual appliances fall short in terms of three-dimensional control of tooth position and patient comfort, and tend to require complex and time-consuming laboratory procedures. For example, Ormco-Kurz Generation 7 brackets (Sybron Dental Specialties, Orange, California) demonstrate good torque and tipping control and a versatility which permits them to successfully treat almost all types of malocclusion, but they are very bulky, which causes patients numerous phonetic, hygiene, and comfort problems, as well as gingival inflammation and tongue lesions.1,2 Smaller brackets however, like those introduced by Philippe, despite guaranteeing better patient comfort and a reduction in phonetic interference, are biomechanically ineffective when tipping or torque control are required. Unsurprisingly, these limitations have led to the poor diffusion of lingual appliances throughout the years.

In contrast, the light lingual system philosophy and the STb brackets (Sybron Dental Specialties, Orange, California) stem from the intent of Professors G. Scuzzo and K. Takemoto to create a comfortable aesthetic appliance, able to guarantee optimal three-dimensional dental position control. Moreover, this appliance was developed not only to simplify clinical procedure and reduce chairside time, but also to decrease reliance on laboratory intervention, and therefore cost. This does not mean that with the light lingual system the orthodontist can avoid the responsibility of good treatment planning or ignore the necessity of knowing how to carry out adaptation of the device during the course of treatment. An efficient and efficacious appliance is only one of the crucial factors that, along with clinical experience and know-how, permit the orthodontist to offer optimal treatment tailored to each patient.3

Development of a New Lingual Bracket

The concerns outlined above prompted Scuzzo and Takemoto to design and develop an innovative lingual bracket, which they named STb (Fig. 1). The useful features of these brackets are many and varied. First and foremost, they are of reduced thickness and mesiodistal dimension. This miniaturization permits both improvement of patient comfort (phonation, hygiene and gingival inflammation) and increase in interbracket distance. Considering that the force exerted by an orthodontic wire is inversely proportional to the cube of the interbracket distance, even small reductions in slot width can increase the elasticity of the wire and therefore permit the use of lighter forces.4,5 Furthermore, as demonstrated by Kusy, an increase in interbracket distance is also able to influence the critical angle (the angle formed between the slot axis and the orthodontic wire), which is the determining factor as far as the binding effect and friction are concerned.6 Another feature of the STb bracket are the steps lateral to the slot; these impede contact between the ligatures and NiTi archwire, (cross sections of up to 0.012 inches) thereby eliminating friction without affecting binding efficiency (Fig. 2).

This bracket has a horizontal loading 0.018 × 0.025-inch slot, which guarantees good tipping control and the possibility of controlling torque with square 0.0175 × 0.0175-inch or rectangular wires whenever necessary. Moreover, the inclusion of wide beveled wings enables the use of elastic or metal ligatures, avoiding the need for the double-over tie characteristic of Ormco-Kurz Generation 7 brackets (Fig. 2).

Unlike other straight-wire appliances, there is no need for different brackets corresponding to each tooth. Instead, in order...
to simplify appliance handling, the following STb bracket types are available:

- one type of bracket for maxillary and mandibular incisors and canines (40° or 55° torque prescription)
- one type of bracket for all premolars (0° or 11° torque prescription)
- one type of bracket for all mandibular molars
- one type of bracket for maxillary molars (10° torque prescription)

All STb brackets are manufactured out of an austenitic steel alloy, which ensures excellent biomechanical characteristics and high corrosion resistance. Welded to the slot is the base, which incorporates a single-layer mesh with a roughly 100 μm-thick weave to ensure optimal composite penetration (Fig. 3).

The Light Lingual System

In addition to the use of STb brackets, the light lingual system philosophy involves the exploitation of particularly light forces, especially in the initial phases of treatment. The sequence of archwires utilized in a lingual system will differ from those required for labial treatment. The reduced lingual interbracket distance means the same wire could exert a three-times greater force in the lingual side than on the labial side. Thus, the first archwire to be inserted for lingual alignment should be extremely resilient (0.012- or 0.013-inch NiTi). This wire not only enables the use of light forces, but also permits control of binding and friction in the first phases of treatment, thereby aligning the teeth in a more rapid fashion.1

Although the ideal orthodontic force has not yet been defined, it is always preferable to use the smallest force possible in order to minimize the areas of hyalinization at the periodontal ligament, and thereby lower the risk of root resorption.

Finally, this system allows adaptation of the appliance complexity to suit the needs of the patient. Although the STb bracket is compatible with all of the most common laboratory (Targ, Class, and Hiro system) and digital (Orapix) indirect bonding techniques, it is not always necessary for torque to be controlled, and in such cases these brackets can be used for simplified bonding of the canines and incisors (the “social six”) or all dental elements. This reduces the cost considerably, and permits the orthodontist to be independent of the laboratory in less complex cases.

Social Six Treatment

The “Social Six” treatment is a clinical procedure proposed by Scuzzo and Takemoto for the correction of all malocclusions with slight to moderate crowding or diastemata limited to the anterior portion of the maxillary and mandibular dentition. This is an invisible treatment, which necessitates no patient collaboration and limited chairside time. Patient comfort is favored due to the use of small brackets (STb) attached only to incisors and canines and, in a small number of cases, the first premolars.

Social Six generally involves the use of round, very light wires. It cannot be used in cases requiring torque control of one or more dental elements. Thus, the bracket positioning in this technique does not require complex laboratory procedures, and can be performed by the orthodontist directly on the malocclusion model of the patient (simplified indirect bonding). Bracket transfer is carried out by means of transfer masks. Scuzzo and Takemoto suggest that this be performed using thermoplastic glue to optimize precision.

The first archwire positioned must be very resilient (0.012- or 0.013-inch NiTi or CuNiTi) to ensure light forces and rapid dental movements, and will remain in place for a period of five to 16 weeks. If necessary, post-treatment finishing can be carried out using a more rigid wire (0.016-inch NiTi or TMA beta-titanium) (Figs. 4-27).
Lingual Straight Wire with STb Brackets

In all cases where dental torque control is required, indirect bonding of the STb brackets must be performed using laboratory techniques (Hiro System) or digital systems (Orapix), both of which require a setup. Correct execution of the setup affects not only bracket positioning, but also successful treatment outcomes.

In cases treated exclusively by orthodontic means, subsequent to space creation by stripping or anterior or transverse expansion (nonextractive cases) or by extraction (extractive cases), treatment mechanics must be applied in order to obtain stable occlusion and correct function.

The treatment phases are:
1. alignment and leveling
2. rotation and torque control
3. space closure
4. finishing

The alignment and leveling phase is performed using a 0.012- or 0.013-inch NiTi archwire. During this phase, it is possible to increase the space in the arch by means of stripping or transverse expansion. In the second phase of treatment, rotation is controlled by means of a 0.016-inch TMA archwire. In cases requiring torque control, rectangular 0.017 × 0.017-inch NiTi or 0.0175 × 0.0175-inch TMA wires should be used. The space closure phase is subsequently performed using rectangular steel 0.017 × 0.025-inch or square TMA 0.0175-inch wires, although round 0.016-inch TMA wires, which permit folding, may be necessary.

Lingual Straight Wire

Since Fujita introduced multibracket lingual appliances in the 1970s, the most commonly used form, for anatomical reasons, has been the mushroom. However, the need to create numerous folds translates into prolonged chairside time and difficulty in achieving optimal results. To simplify lingual bracket use, Scuzzo and Takemoto developed the lingual straight wire method in 2001.7 The authors were prompted to better utilize the straight lingual wire to markedly reduce the differences in thickness between canines and first premolars by positioning the canine and maxillary and mandibular incisor brackets closer to the gumline.

The first of these appliances caused several problems due to the thickness of the brackets involved and the interbracket distance, resulting in patient discomfort. Undeterred, they recently developed a new system of brackets and arch forms, which permits a pure lingual straight wire to be employed, minimizing the thickness of the composite bases of the brackets and considerably reducing chairside time.

To enable use of a lingual straight wire, the STb bracket was modified by inclusion of a gingival offset, which permits the slots for anterior teeth to be positioned closer to the gingival margin. However, the new, improved bracket retains the horizontal 0.018 × 0.025-inch slot and the friction-reducing lateral steps, although the width of the slot is reduced to increase the interbracket distance. To allow straight wire usage and slot positioning as close to the tooth surface as possible, Scuzzo and Takemoto recommend that the premolar and molar brackets be positioned halfway up the clinical crown, and the canine and incisor brackets be positioned at the top of the gingival third of the crown.8,9

When lingual straight wires are employed, indirect bracket bonding is obligatory after manual or digital setup. This phase, along with accurate diagnosis and effective treatment planning, is crucial for ensuring successful treatment outcomes. However simple and effective a device, it is not able to guarantee the desired results on its own (Figs. 28-47).

Conclusion

The light lingual system is a continuously evolving system of brackets and archwires, which can be adapted for the treatment of the most diverse types of malocclusion cases. Using the STb brackets, it is possible to combine three-dimensional control of the teeth with patient comfort and aesthetic expectations.
Author's Bio

Dr. Giuseppe Scuzzo, graduated in medicine in 1983 (Rome University) and specialized in dentistry in 1987 (Rome University) and orthodontics at Ferrara University. He collaborates (as a teacher) with the major European Universities, and is a professor in the lingual technique at Ferrara University and adjunct Professor at New York University. He is also director of the First International Master in Lingual orthodontics at Ferrara University. Dr. Scuzzo has a private practice limited to lingual orthodontics in Rome, Italy.

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