Invisible Orthodontics

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Introduction

In recent years the aesthetics of the orthodontic appliance has become a topic of great interest with increasing numbers of adults receiving orthodontic treatment. The prospective orthodontic patient today expects a beautiful smile at the end of treatment, but is equally concerned with appearance while undergoing treatment. In an attempt to meet this need for an attractive bracket, manufacturers by first decreasing the size and profile of metal brackets, and then introduction of tooth colored/ceramic brackets and ‘Invisible’ or ‘lingual’ brackets. Due to increasing esthetic demands of young patients and thanks to clinical simplification in customized lingual appliances, the indication of lingual orthodontics today is no longer restricted to adults, but has been extended to adolescents, the major treatment cohort of orthodontists. Invisible (lingual) orthodontics represents the only solution that does not impair the patient from an esthetic point of view. All patients and not only adults attach importance to their appearance and for social or work reasons would probably refuse conventional orthodontic treatment.

Historical Perspective

In early 1970s Dr. Craven Kurz an orthodontist, then assistant professor of occlusion and gnathology at the UCLA School of dentistry, realized that his private practice was majorly constituted by adult patients. As many of his patients were public figures, esthetics became a major concern. A particular patient, who was an employee of the Playboy Bunny club, presented to his practice requesting treatment. Because of her public position she refused metal or plastic labial appliances on esthetic grounds. From her demand for an appliance that did not show, the concept of lingually bonded appliance was born. Dr Kurz applied for the Patent of Kurz lingual appliance in 1976.He Collaborated with Ormco and product development began in earnest in 1978.Ormco manufactured a usable metal bracket in 1979. Clinical trials led to improvements in the product design and eventually several generations of Ormco Lingual Brackets came were introduced in
the market. Currently we are using 7th generation of the Ormco Lingual Appliance.7

**Advantages**

1. Facial surfaces of the teeth are not damaged. (Figure 1)
2. Facial gingival tissues are not adversely affected. (Figure 2)
3. The position of the teeth can be more precisely seen.
4. Facial contours are truly visualized since the contour and drape of the lips are not distorted by protruding labial appliances. (Figure 3)
5. Most adult and many young patients would prefer "invisible" lingual appliances if costs, treatment times, and results were comparable to those of labial appliance treatment.

**Indications**

**Ideal Cases**
- Low Angle Deep bite
- Diastema
- Class I minor crowding
- Class II upper bicuspid extractions

**Difficult cases**
- 4-Bicuspid extractions
- Posterior cross bite

**Contraindicated cases**
- Very short clinical crown
- Severe Periodontal disease
- Severe TMD

**New Straight Wire Technique**

Takemoto and Scuzzo developed the lingual straight-wire (LSW) technique in 199516. Mushroom shaped arch wires require inset bends and vertical steps between canines and premolars thus requiring complicated wire bending.14 A new STb light lingual system was introduced in 2009 which is narrower mesiodistally than the previous version (Figure 4, 7), which increases the interbracket distance and thus reduces both the force transmitted by the arch wire and resistance to sliding mechanics. The thinner bracket pad, places the bracket slots much closer to the lingual tooth surfaces, further increasing the interbracket distance.17

The new gingival-offset slot position reduces in-out thickness, enhancing patient comfort and avoiding occlusal trauma from the opposing teeth.
New LSW appliance uses a planar arch form to make arch coordination less difficult and permit the use of simpler mechanics, such as sliding techniques. It eliminates the need for inset bends between canines and first premolars. (Figure 5)

The Kommon base, developed by Komori in 2008, is the latest indirect-bonding method for lingual orthodontics. In this system, an anatomical extension of the resin pad between the bracket base and tooth surface allows customization of the lingual brackets. Using a glass ionomer cement for bonding not only permits working in wet conditions without etching, but also allows direct transfer of the brackets to the teeth without the need for a tray. (Figure 6)

Recommended wire sequence for non-extraction treatment is:
1. Leveling— 0.012" nickel titanium or 0.013" copper nickel titanium
2. Rotation control— 0.014" or 0.016" X 0.016" nickel titanium
3. Torque establishment—
   - 0.017" X 0.017" or 0.018"
   - 0.018" nickel titanium or 0.0175" X 0.0175" TMA
4. Finishing and Detailing— 0.016" TMA

For extraction treatment:
1. Leveling— 0.012" nickel titanium or 0.013" copper nickel titanium
2. Rotation control— 0.014" or 0.016" X 0.016" nickel titanium
3. Torque establishment—
   - 0.017" X 0.017" or 0.018"
   - 0.018" nickel titanium or 0.0175" X 0.0175" TMA
4. Space closure— 0.016" X 0.022" or 0.017" X 0.025" stainless steel
5. Finishing and Detailing— 0.016" or 0.0175" X 0.0175" TMA

With proper attention being given to setup, accurate bracket positioning and indirect bonding technique, straight wire technique will not only save chair side time but will also enhance patient comfort.

Self Ligation in Lingual Orthodontics

Self ligation in lingual orthodontics was first described by Macchi et al. in 2002 with the Philippe Self Ligating Lingual Brackets that can be bonded directly to the lingual tooth surfaces. Self ligation in lingual orthodontics has touched new horizons with the launch of interactive lingual brackets like Evolution SLT® by Adenta. It has a non-locking rotating clip resulting in unique flexibility. It comes with a self-ligating clip flexes like an elastomeric ligature and therefore responds to the actual malocclusion without losing force (Figure 8), which reduces binding and prevents notching especially with highly rotated teeth. The Evolution SLT® Smart cap (Figure 9) is a unique indirect bonding
system based on the principles of the HIRO® system. It offers the practitioner the benefits of bonding each tooth individually, offering at the same time the speed of a full bonding tray.

Figure 8: Evolution SLT by Adenta

Another precise Lingual Self ligating system comes as Inovation L by GAC which is a interactive, twin, self-ligating lingual bracket system.

Only an interactive bracket provides full functionality throughout the course of treatment. This allows you to enjoy the early benefits of a free-sliding, passive design and the precise control of an active one in the later stages of treatment. (Figure 10)

Figure 9: The Evolution SLT Smart Cap Indirect bonding system

Figure 10: Interactive bracket design

Passive function is achieved with a round Sentalloy® NiTi wire that slides freely for efficient leveling and alignment.

Expressive function where controls is realized and free sliding is maintained. This is created with the light seating of a BioForce® wire into the base of the slot so programming may be expressed and rotations are corrected.

Active function with full control is provided by the introduction of a full-size Resolve® Beta-Ti wire, enabling full expression of the bracket’s torque and achievement of the desired result.

Dentaurum has come up with the World’s first: Nickel free Lingual Brackets called Magic®. Due to the magic® bracket’s unique geometrical form, arch wires can be inserted occlusally. The innovative combination of occlusal and horizontal slot directions enables the arch wire to be automatically pressed into the slot.

Customisation in Lingual Orthodontics

It was first described by Wiechmann et al in 2003. Conventional manufacturing processes cannot completely eradicate the problems associated with Lingual appliance system, instead, complete individualization of all appliance components is needed. The processes of bracket fabrication and optimized positioning of the fabricated brackets on the tooth, which are normally quite separate, are fused into 1 unit. Individualization of them bracket base, a process used in various laboratory processes and always essential in the lingual technique, takes place during fabrication of the single brackets; in other words, each tooth has its own customized bracket, made with state-of-the-art computer-aided design/computer-aided manufacturing (CAD/CAM) software coupled with high-end, rapid prototyping techniques.

Creating a benchmark in the customized lingual appliance is the Incognito™ Appliance System (3M UNITEK) (Figure 11).
This computer-generated appliance uses three-dimensional (3D) computer scanning to ensure efficiency of tooth movement by designing brackets and bonding pads specifically for each individual tooth with the bracket slot in the most advantageous position on the lingual surface of the dentition. Brackets are printed using a stereolithography apparatus and then cast in gold bracket bases are drafted, tie-wings and hooks are adjusted and brackets are assembled on the base in the optimal position. A series of archwires is then created by a wire-bending robot to achieve the orthodontist’s treatment goals; bending archwires by hand would be difficult and reduce the efficiency of this appliance. The Incognito System brings the option of lingual treatment to the next level.

The customized brackets and robotically bent wires are engineered to work together to deliver the targeted result you define through a high-quality appliance system.

Clear Aligners
Adding another star to the Invisible orthodontic treatment is the Clear Aligner Therapy. Clear aligner treatment falls into two basic categories. The first category consists of those thermoformed appliances, sometimes known as Essix Retainers (Raintree Essix, Dentsply Corp., York, PA), that are fabricated by making adjustments to the tooth positions on plaster or stone models and fabricating one or more aligners to correct a minor malocclusion.

These types of appliances are oftentimes fabricated in the orthodontist’s office or sometimes sent out to commercial laboratories to be made under a trademarked name such as Simpli 5 (Simpli 5 Express Aligner System, Ormco Corp., Orange, CA). These types of in-office prepared aligner systems have been in use since around 1994. Invisalign (Align Technology, Inc., Santa Clara, CA) is a proprietary orthodontic technique that uses a series of computer generated custom plastic aligners to gradually guide the teeth into proper alignment. Invisalign is both a brand name and a technique and is used synonymously. Now there are other commercially available aligners as well, CA® CLEAR-ALIGNER technique...


**Figure 12:** Clear aligners

**Conclusion**

Painstaking efforts, methodological approach, and the vast experience gained over the years by various pioneers in the discipline has proved beyond doubt that this specialty of orthodontics has the answer to the ever increasing cosmetic demands of the patients who insist on appliances which are not seen to the outside world and at the same time want to get their malocclusion treated.

Today, the main goal is to achieve facial balance, and the development of orthodontic treatment is the balance between esthetical treatment, functionality and a patient's aspirations. Esthetic aspirations are now universal and involve younger patients including both male and female adolescents. In this regard, invisible orthodontics, which is highly esthetic play a fundamental part in achieving dental alignment. A smile revealing esthetic harmony is very important at an age as difficult as that of adolescence. Invisible orthodontics thus represents the best solution for meeting the needs of the patients without the risk of damaging biomechanical efficiency. 

Though this discipline is practiced by a small well knit community, it should become a part of every orthodontist’s armamentarium if one has to have a competitive edge in this ever changing world of challenges and opportunities.

**References**


28( SCHEU-DENTAL) and CLEARPATH (ClearPath Orthodontics ®) (Figure 12)
29. Clear Aligner™ CA Laboratories Ltd http://www.clearaligner.co.uk/doctors/why-clear-aligner