LINGUAL ORTHODONTICS VERSUS LABIAL ORTHODONTICS: AN OVERVIEW

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Abstract
Lingual orthodontics came into existence to eliminate the visibility of the appliance by sparing the labial surfaces and making use of lingual surfaces to fix orthodontic attachments for esthetic reasons on the demands of adults. This lingual technique presented a challenge being much different in treatment approach as compared to labial orthodontics due to working area with poor accessibility, anatomical variations of lingual surfaces posing difficulty in getting accuracy of bracket positioning, different mechanical considerations due to the position of orthodontic attachments having different relationship with centre of resistance, different nature of problems to the patients due to its different location and various other factors. It requires a lot of patience, efforts, skill and time from the orthodontist and good cooperation from the patients understanding the extended chair time, increased cost, increased duration as well as the discomfort associated with it especially speech and tongue soreness. This article is an attempt to present an overview of lingual orthodontics as compared to labial orthodontics.

INTRODUCTION
Fixed orthodontic appliance has been brought into practice by making attachments fixed on the labial/buccal surface. Teeth have only labial/buccal surfaces and lingual surfaces available for fixing the attachments of the appliance to facilitate the delivery of the desired force. Labial/buccal surfaces allow more convenient approach for manipulation of fixed appliance. The need of fixing the attachments on the lingual surfaces better known as lingual orthodontics has evolved in an attempt to hide the appliance due to esthetic reasons. The demand especially came from the adults due to psychosocial reasons. Lingual orthodontics came into existence as a viable option for orthodontic patients in 1970's with the pioneering works of Craven Kurz of USA and Kinya Fujita of Japan. Three-dimensional control of crown and root position is possible with attachments on the lingual surface as labial/buccal surface but different treatment considerations are required in lingual orthodontics than labial orthodontics.

- Considerations Regarding Appliance placement
Lingual orthodontics presents difficulty for appliance placement firstly, due to difficulty in direct accessibility to lingual surfaces and secondly, due to anatomic variations of the lingual surfaces and thereby, increasing the chances of inaccuracy of bracket positioning. Precise bracket positioning is important for successful treatment. A change in bracket position on lingual side will have a greater effect on the final tooth position than the same change when applied on labial aspect because lingual brackets are bonded distally from the labial surface that has to be aliened. Precise bracket positioning is achieved either by direct bonding with lingual jigs, which also enables indirect bonding or by
indirect bonding using TARC system (Torque Angulation Reference Guide), the slot machine, the CLASS system (Customized Lingual Appliance Setup Service), the CRCS system (Convertible Resin Core System), the bending arch technique, the TOP system (Transfer Optimized Positioning). Direct bonding is less accurate, therefore indirect bonding is preferred. The practice of lingual orthodontics requires the support of a laboratory. A few different set of instruments are added to the armamentarium. TOPOS (Transfer Optimized Positioning).

- Considerations Regarding Mechanics

Wire bending is more complicated as it requires the sizeable first-order bend on the lingual side between canine and the premolar making the archwire in a mushroom shape. This problem is overcome to some extent by the use of prefabricated archwires with a straight wire concept. Though the usual approach of placement of orthodontic attachments is the use of custom brackets with elaborate prescription allowing the use of preformed archwires with little or no wire bending but, recently the option of using less expensive brackets with little or no straight wire compensations with archwires having all the bends incorporated by a wire bending robot using laser scars is being explored. The robot arch wire fabrication is too expensive at present. The interbracket span is reduced especially in the anterior region considerably, making the wire seem approximately three times as stiff as when used with labial fixed appliance for first order, second order bends and approximately one and a half times as stiff for third order bends. Point of force application is different in lingual orthodontics influencing the relationship of line of force with centre of resistance. Therefore, tooth movements with lingual orthodontics need a different biomechanical consideration than that with labial orthodontics. Reduced distance between point of force application and centre of resistance in the lingual technique leads to smaller moments of force making torque control more difficult as well as influencing first, second and third order bends. Vertical forces in lingual orthodontics may produce much more complicated and unpredictable tooth movement because these vertical forces affect the teeth differently with change in tooth inclination and also much more sensitive to the bracket position than that in labial orthodontics. In lingual orthodontics, intrusion is accompanied by labial tipping due to force vector passing labial to centre of resistance. In lingual orthodontics, intrusion of normally inclined or proclined teeth is accompanied by little or no labial tipping due to force vector passing or closer to centre of resistance whereas that of retroclined teeth is accompanied by further lingual tipping due to force vector passing lingual to the centre of resistance. In labial orthodontics, extrusion is accompanied by labial root movement, but in lingual orthodontics, extrusion shows complexity in that teeth with different inclinations except those with more than 20% inclinations to the occlusal plane show lingual root movement latter showing labial root movement.

Reduced arch perimeter in the anterior region of lingual tooth aspect makes it difficult to apply light forces and also reduces activation range as well as constancy of force. Increasing the wire length by incorporating loops is not possible because of limited space. Hence, the options for increasing the resiliency of the wire are either by the use of resilient wires with decreased modulus of elasticity such as shape memory wires or decreased cross-section of the wire. The smaller arch perimeter, by increasing the rigidity of lingual arch wires, increases the anchorage control during retraction. The higher anchorage value of posterior teeth with the lingual appliances is firstly, due to the nearness of the lingual brackets to the centre of resistance of the teeth reducing the chances of tipping and secondly, by creating a buccal root torque and distolingual rotation of the molar crown during following space closure, in turn providing cortical bone anchorage.

Retraction force used with lingual technique is threefold lower than that with the labial technique because of the use of sliding mechanics with elastomeric chain showing more than 50% force decay in four weeks. In lingual orthodontics retraction force with intrusive force in an equal amount applied to normally inclined or proclined teeth shows a net force vector passing lingual to centre of resistance leading to lingual tipping of maxillary anterior teeth in contrast to the labial technique where the net force vector passes through the centre of resistance. Hence, in lingual orthodontics this lingual tipping coupled with anterior bite plane effect of lingual brackets on maxillary anterior teeth causing posterior discusion lead to loss of lateral occlusal function resulting in vertical bowing effect. Therefore, retraction is carried out using stiff wires alongside less force with more intrusion and torquing force in lingual orthodontics. The sliding mechanics with lingual orthodontics also has the advantage of being effective in preventing transverse bowing effect leading to undesired buccal tipping of premolars and distolingual rotation of molar without using any auxiliary such as transpalatal arch. The lingual orthodontics shows expansive nature especially during alignment.
effect was first attributed to increase in tongue pressure as a result of placement of appliance on the lingual aspect but later it was realized to be a mechanical side effect/bowing effect, which can be controlled by use of stiff wires while retraction

• Considerations Regarding Patient’s Acceptability to the Appliance
Both labial and lingual patients feel some discomfort at the beginning of the treatment and adaptation period for the patient to be comfortable with the appliance was the similar in the patients with either of the technique i.e. 4 weeks. Patients felt discomfort localized in lip and cheek areas with labial appliance, whereas those with lingual appliance complained of tongue soreness as a common occurrence. No difference was observed in the eating and oral hygiene maintenance, but food sticking was reported higher in lingual group. Speech was found to be severely affected in patients with lingual appliance. Patient should be very cooperative and able to understand the discomfort caused by the appliance and need to be tolerant.
Lingual orthodontics is associated with extended chairtime in comparison to labial orthodontics by 30% to 50% or even upto 100% according to different studies. Increase in time, effort and support of a laboratory all lead to increase in the cost, which may discourage a patient from seeking lingual orthodontic treatment.

In labial orthodontics, white spots on the labial surfaces around the orthodontic attachments may be discovered after the removal of appliance leading to unesthetic appearance. In lingual orthodontics, such chances of white spot formation on labial surfaces can be eliminated by maintenance of proper oral hygiene as labial surface is spared of orthodontic attachments. This advantage is in favour of lingual orthodontics.

• Considerations Regarding Selection of Appliance
The lingual appliance has a bite opening effect due to the position of lingual brackets on maxillary anterior teeth contacting incisal surfaces of lower incisors in deep bite cases as well as expansive nature. Therefore, the favourable cases are low angle, deep bite cases, mild crowding cases requiring expansion and class II cases requiring maxillary premolars extraction. Difficult cases are those requiring all first premolars extraction, high angle cases, anterior openbite cases and surgical cases. Unfavourable cases making contraindication to lingual orthodontics are cases having short clinical crowns less than 6 mm, poor periodontal status, poor oral hygiene, patients having criticizing and restless tendency with a little hope of understanding the problems of discomfort, high angle cases, severe class II discrepancy and acute TMJ dysfunction.

Conclusion
Lingual appliance is a viable option for the patients seeking fixed orthodontic treatment. It is a well-tolerated appliance. Speech problem and tongue soreness may require some more time for adaptation to the appliance. Lingual technique due to poor accessibility, variations in anatomy of lingual surfaces, need of a laboratory and complicated mechanics, increased duration and cost, needs a much different consideration as compared to labial orthodontics. Hence, a good communication between the orthodontist and the patient is required so that patient is able to understand the problems associated with lingual orthodontics and adopts a positive attitude to accept the appliance with good cooperation.

References
12. Profit WR, Fields HW, Sarver DM. Contemporary

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